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ABSTRACT

In 1990 a comparative analysis was conducted of North Dakota student achievement across three forms of distance education: instruction by satellite, audiographic tele-learning, and two way interactive educational television. Based in part on the 1988 study of a German by Satellite program in Missouri and North Dakota, this study mailed questionnaires to the administrator of each school, program coordinators, each student enrolled in distance education courses, and remote instructors. Responses provided information from each group as follows: (1) administrators--the history of their distance learning project, costs in project implementation, administrator, school, and community attitudes toward the project, future of distance learning in their schools, and information for each student on grade point averages, motivation, and course grades; (2) coordinators--how the distance education courses were implemented in each school, what components were built into the program, and the coordinators' role; (3) students--how they felt about the distance education course, assessment of the course as compared to traditionally taught courses, and demographic information; and (4) remote instructors--identification of major factors involved in implementing a distance education course, comparison with traditionally taught courses, and problems or limitations with the technology. The study concludes with several recommendations for previous or potential distance education adopters. Data are presented in both narrative and tabular form. (DB)

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DISTANCE LEARNING IN NORTH DAKOTA:

A CROSS-TECHNOLOGY STUDY OF THE SCHOOLS, ADMINISTRATORS, COORDINATORS, INSTRUCTORS, AND STUDENTS

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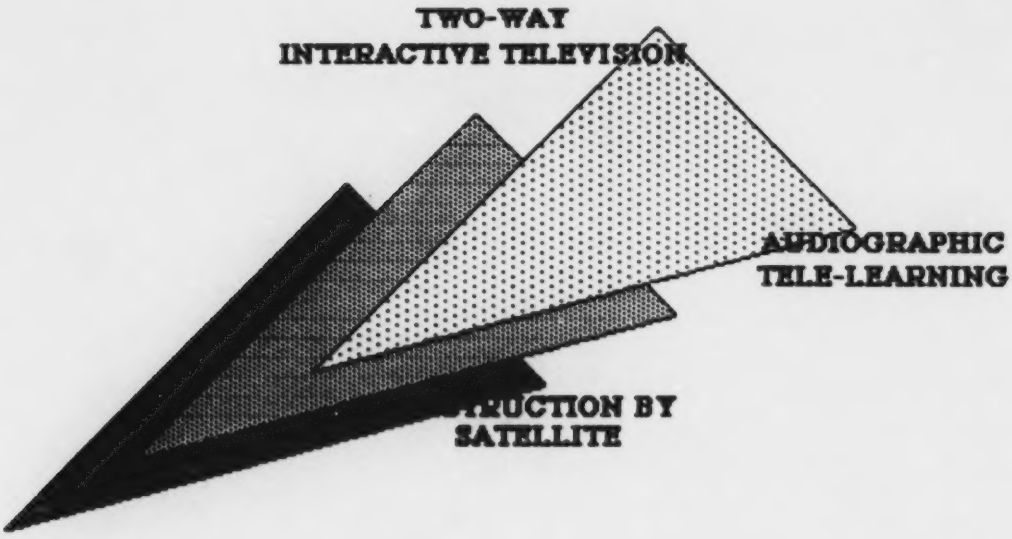

A Study Sponsored by

Mid-Continent Regional Educational Laboratory

Denver, Colorado

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September, 1990

LIST OF TABLES

Table		Page
1	North Dakota Distance Learning Project: 1989-90	3
2	Distance Learning Courses Offered in North Dakota	4
3	Students' Reasons for Enrolling in the Distance Learning Course	7
4	Student Assessment of Course Difficulty and Amount of Homework	8
5	Student and School Categorization of Overall Student Grades	9
6	Amount of Time Students Spent Studying for Distance Learning Classes	9
7	Characteristics Seen as Most Helpful by Students in a DL Class	11
8	Student Assessment of Who Performs Specific Tasks in a DL Class	12
9	Source of Administrator Information about Distance Learning	13
10	Source of Distance Learning Consulting Services	13
11	Types of Assistance Received by Schools Adopting a Distance Learing Technology	14
12	Administrator Perception of Future Use of DL Technology in Their District	15
13	Impediments to Greater Use of DL Technology in Their Own Districts in the Future (As Assessed by Administrators	16

Table		Page
14	Administrator Perceptions of Purposes Served by Distance Learning Technologies	16
15	Administrator Perception of Attitudes Regarding Distance in the School and Community	17
16	Administrator Satisfaction with Distance Learning Program Components	18
17	Factors Contributing to School Decision to Adopt DL Program	19
18	Basis for Distance Learning Student Enrollment	20
19	Importance Attributed to Common Bell Schedules and School Calendars by Administrators in DL Schools	20
20	Administrators' Criteria for Successful Program Implementation	21
21	Administrator Reaction to Potential State Education Agency Activities	22
22	Knowledge/Experience Level of DL Coordinators/ Supervisors	25
23	Type of Training Received as DL Coordinator/Supervisor	26
24	Coordinator Perceptions of Qualifications Necessary in the Role	27
25	Auxiliary Uses of Distance Learning Equipment	28
26	Number of Computers Available to DL Students During Class Time	28
27	Coordinator Rating of Amount Learned by Students (by Technology and by Class)	30

Table		Page
28	Coordinator Comparison of Distance Learning with Traditional Classes	31
29	Coordinator Attitudes Toward Distance Learning Classes	31
30	Coordinator Perception of Why Students Dropped the DL Course	32
31	Coordinator Assessment of Who Performs Specific Tasks in a DL Class	32
32	Problems Listed by DL Coordinators	34
33	Distance Learning Teacher Preparation Time	36
34	Level of Technological Knowledge or Experience of DL Teachers	37
35	Type of Training Received by DL Instructors	39
36	DL Instructor Comparison of Traditional vs. DL Teaching Roles	40
37	Essential Attributes of DL Instructors	40
38	DL Instructor Comparison of DL vs. Traditional Curriculum.	41
39	Methods of Transmission of Homework and Tests	41
40	Frequency of Out-of -Class Contact Between DL Students and Teachers	42
41	Incidence of Out-of-Class, Student-Teacher Contact by Technology	43
42	Instructors' Opinions of Qualifications Necessary for Supervisors of Distance Learning Classrooms	44

Table		Page
43	Reasons for Student Attrition in DL Courses as Indicated by DL Instructors	45
44	Instructor Opinion of Amount Learned by DL Students by Technology	46
45	Instructor Comparison of DL Classes with Traditional Classes	47
46	Instructor Assessment of Who Performs Specific Tasks in a DL Class	48
47	Problems Identified by DL Instructors	49
48	Frequency of Student-Teacher Interaction During Class Time by Technology	51
49	Coordinator and Instructor Comparison of Distance Learning With Traditional Students: Amount Learned and Student Frustration	52
50	Coordinator and Instructor Comparison of Distance Learning With Traditional Students: Student Effort Required	53
51	Coordinator and Instructor Comparison of Distance Learning With Traditional Courses: Learning Opportunity	54
52	Coordinator and Instructor Comparison of Distance Learning With Traditional Courses: Only Viable Alternative	54
53	Coordinator and Instructor Comparison of Distance Learning With Traditional Courses: Preferable to No Course	55
54	Distance Learning Costs in North Dakota	57
55	Achievement Test Scores by Technology	60
56	Relative Student Characteristic Advantages and Disadvantages to Hypothesized Student Achievement by Technology	62

Table		Page
57	DL Student Class Rank by Student Achievement Test Scores in German and Spanish	63
58	Student GPA's by Achievement Test Scores in German and Spanish	63
59	Student Motivation Level by Achievement Test Scores in German and Spanish	64
60	Student Grade Level by Achievement Test Scores in German and Spanish	65
61	Characteristics Thought by Students to be Most Helpful in a Distance Learning Course by Achievement Test Scores in German and Spanish	65
62	Effect of Implementation/Student Utilization of Non-Broadcast Course Components in OSU German by Satellite on Student Standardized Test Scores	67
63	Effect of Instructor Access Components in OSU German by Satellite on Student Standardized Test Scores	69
64	Student Perception of Whether Course Improvements are Needed by Achievement Test Scores in German & Spanish	70
65	The Effect of Performance of Selected "Teacher Tasks" in DL Class on Achievement Test Scores in German and Spanish	71
66	Amount Learned in Students' Perception	72
67	Student, Instructor, and Coordinator Perception of Amount Learned by DL Students	73
68	Second Semester Grades for DL Students by Technology	74
69	Would Students Enroll in Another Distance Learning Course?	74

Table		Page
70	Student Perception of Whether Improvements are Needed in the Distance Learning Course	75
71	Combined DL Student Results on National Examinations in Spanish and German	76
72	Student Results on Spanish and German National Achievement Tests by Subject Area	77
73	Summary of Student Success Measures in DL Courses	79
74	Comparison Ranks of Distance Learning Technology Sub-Types: A Composite Assessment	89

Diagram		Page
1	Grade Level of Enrolled Students	8
2	Student Perception of Amount Learning	10
3	Student-Teacher Interaction	11
4	Other Positions Held by DL Supervisors	23
5	Number of Other Classes Taught	24
6	Number of Other Class Periods Taught	24
7	Technology Experience "Scores" of Individual DL Instructors	38

DISTANCE LEARNING IN NORTH DAKOTA: A CROSS-TECHNOLOGY STUDY OF THE SCHOOLS, ADMINISTRATORS, COORDINATORS, INSTRUCTORS, AND STUDENTS

INTRODUCTION

Among its more unique attributes, North Dakota prides itself in the ingenuity of its people--its pioneer spirit in an age of decreasing rugged individualism. So it is not unlikely that a state such as North Dakota has jumped head-first into the several forms of distance learning, neither dragging its feet over regulatory measures nor dictating *which* forms of distance learning will be adopted.

Not that North Dakota has acted serendipitously--the need for curriculum expansion in light of greater requirements has certainly prompted the exploration into distance learning. One-third of North Dakota's high schools have enrollments fewer than 50 students; two-thirds have fewer than 100 students. A significant number of districts have difficulty implementing art, foreign language, or advanced science and math programs through traditional means. Less than two-thirds of the high school districts offer a foreign language course; one-fourth have no advanced math class; one-third have no Physics and/or Chemistry course; and less than 40% include an art class in their curriculum.

Having suffered decreased state funding for education, largely because of a prolonged slump in energy and crop prices, North Dakota's 1988 state appropriation of $346.4 million was $42 million less than was spent on public schools in 1981. Foundation Aid to North Dakota schools alone dropped from $184.4 million in 1981-82 to a low of $171 million in 1989-90, a gradual decrease of more than $13 million dollars to the state's schools in the nine-year span . This has further exacerbated the problem of implementing a broader curriculum. School districts have found their budgets necessarily sliced by significant percentages and are unable to hire additional teachers even if teachers were available. With 40% of their budget coming from local/county sources, the economically difficult times of the last few years has not allowed an increase in taxes, regardless of need.

Faced with no alternative, 32 North Dakota schools have been forced to close or consolidate over the last decade. In spite of the bleak picture painted by the region's economics, however, North Dakota has a history of strong family and community support for education. This, perhaps, is best illustrated by the state dropout rate. North Dakota has one of the lowest dropout rates in the country--a distinction shared only by Minnesota and Wyoming. North Dakota's current annual dropout rate is 1.77%, with a 1988-89 four-year persistence to graduation rate of 92.85%. This undeniably strong value placed on education has led North Dakotans to seek other solutions to their unrelenting problems.

The rational interest in distance learning in North Dakota came about in 1987 with seven districts' involvement with German by Satellite offered through Oklahoma State University. Technology conferences put together by the Department of Public Instruction and Mid-Continent Regional Educational Laboratory served to further increase awareness of the technological options available--Audiographic Tele-learning and two-way Interactive Television--in addition to Instruction by Satellite by the several national providers available.

During the 1989-90 school year, 27 public and 1 private North Dakota secondary schools were involved in distance learning programs:

- 12 high schools utilized Instruction by Satellite
  - -- 2 with TI-IN Network
  - -- 5 with SERC (Satellite Educational Resources Consortium)
  - -- 5 with Oklahoma State University's Arts and Sciences Teleconferencing Service (ASTS)
- 9 high schools utilized two-way Interactive Television
  - -- 4 with an Analog system
  - -- 5 with a Digital system
- 7 high schools utilized an Audiographic Tele-learning system

A list of North Dakota schools currently operating a distance learning program is included in the following table:

TABLE 1
NORTH DAKOTA DISTANCE LEARNING PROJECTS
1989-90

Consortium/School	Technology	Participant Schools
West River	Analog I-TV	Beulah, Center, Hazen, Stanton
Souris Loop	Digital I-TV	Velva, Sawyer, Towner, Karlsruhe, Granville
Red River (OSU)	Instr. by Satellite	Central Valley, Hatton, Shanley, Richland, Mayville-Portland
SERC	Instr. by Satellite	Fargo South, Fargo North, Mandan, Dakota, New Town
TI-IN	Instr. by Satellite	Alexander, Drayton
Missouri Valley	Audiographic Instr.	Turtle Lake, Garrison, Riverdale, Underwood, Washburn, Wilton, Century High

Courses offered through one of the three distance learning technologies included: Spanish I, German I, Art 1, Russian 1, Anatomy/Physiology, Psychology/US History, Advanced Economics, Parenting/Child Development, Japanese I, Accounting II, AP Micro/Macro Economics, Speed Writing, Advanced English, German II, Accounting III, Art History/Appreciation, French, and Latin. North Dakota student enrollments in each can be seen in the following table:

TABLE 2

DISTANCE LEARNING COURSES OFFERED IN NORTH DAKOTA

Technology	Courses Offered	Students Enrolled 2nd Sem 1989-90	Total
Analog I-TV	Spanish I	23	
	US History	21	
	German I	38	
	Adv. Biology	21	
	Accounting II	13	
	Child Dev	13	
			129
Digital I-TV	Speed Writing	12	
	Spanish I	20	
	Art I	15	
	Adv. English	18	
	Accounting III	3	
			68
Satellite (OSU)	German I	33	
	German II	8	
	Adv. Economics	15	
			56
Satellite (SERC)	Japanese I	13	
	Russian I	20	
	AP Micro Economics	11	
			44
Satellite (TI-IN)	Spanish I	2	
	Japanese I	1	
	Latin	1	
	French I	2	
	Art Appreciation	3	
			9
Audiographic	Spanish I	28	
			28
	TOTAL STUDENTS		334

METHODOLOGY

In May, 1988 a research study was initiated involving all schools in Missouri and North Dakota who had implemented German by Satellite from Oklahoma State University. The purpose of the study was to look at distance learning programs in an evaluative light in order to help both previous and potential adopters understand the methods of implementation most closely related to student success and to understand what other factors are involved in successfully implementing a distance learning project. Questionnaires were administered in both states to: (1) the administator of each school responsible for initiating the program; (2) the program coordinator, e.g., the person in the local classroom responsible for coordinating or supervising the course; (3) each student enrolled in German I by Satellite; and (4) a parent of each enrolled student. In addition, students were given a standardized German test to be used as a relative measure of achievement against which input variables could be weighed. Research findings were compiled in *Distance Learning Evaluation Study (Report II): An Inter- and Intra-State Comparison* (published by Mid-Continent Regional Educational Laboratory) which detailed the study's findings and set forth recommendations to adopters of instruction by satellite programs.

With the upsurgence of multiple forms of distance learning across North Dakota, a second research study was undertaken by McREL in April, 1990. This time the focus of the study was the comparative analysis of North Dakota student achievement across the three major forms of distance learning--Instruction by Satellite, Audiographic Tele-learning, and two-way Interactive Television. With the assistance of the North Dakota Department of Public Instruction and Mayville State University, questionnaires were mailed to: (1) the administator of each school most familiar with the program; (2) the program coordinator, e.g., the person in the local school responsible for coordinating or supervising the course; (3) each student enrolled in all distance learning courses; and (4) the remote instructors involved in each course originating in North Dakota. In addition, national standardized tests were administered to all North Dakota distance learning students enrolled in either Spanish I or German I by any of the various forms of distance learning. The two language courses, in which standardized tests were administered, were chosen because of the larger number of students enrolled in those courses, the existence of a national standardized test in those subjects, and the offering of the course across multiple DL technologies.

The study involved 27 of the 28 North Dakota districts having implemented some form of distance learning--one private high school chose to not participate in the study. Completed questionnaires were received from 24 of the 27 administrators (89%), 23 of the 27 project coordinators (85%), 12 of the 12 remote instructors (100%), and 275 of the 334 students involved (82%). Achievement test data was received from 56 of the 72 Spanish I students (78%) and 63 of the 71 German I students (89%).

Appropriate caution should be taken with tentative conclusions based on relatively small numbers of cases. Definitive conclusions must await a multi-state or national study involving a greater number of schools, programs, and students.

The following results are organized around four major topics, corresponding to the respondents of each questionnaire. The **administrator questionnaire** dealt largely with the history of the project-- including costs involved in project implementation--the administrator, school, and community attitudes toward the project, and the future of distance learning in their school. As an addendum to the administrator questionnaire, respondents were asked to complete information for each enrolled student concerning GPA, rank in class, student motivation level, and 1st and 2nd semester course grades. The **coordinator questionnaire** dealt more specifically with how the course(s) was(were) implemented in each school, what components were built into each program, and the role played by the coordinator in each school. The **student questionnaire** was primarily attitudinal in nature, trying to ascertain how the student felt about the distance learning course, their assessment of the distance learning course as compared to traditionally taught courses, and some demographic information about the student. The **remote instructor questionnaire** attempted to identify some of the major factors involved in implementing such a course, its comparison with traditionally taught courses from the instructors' point of view, and any problems or limitations seen with the technology.

DISTANCE LEARNING STUDENT DATA

Remote Site vs. Site of Origin

Two hundred seventy-five students responded to the distance learning questionnaire, representing all technologies having been implemented in the state. Seventy-two percent (72%) of the students attended "remote site" schools, meaning they were enrolled at sites in which the course instructor was not physically present; twenty-nine percent (29%) of the students attended schools from which the distance learning course originated, i.e., an I-TV or audiographic class in which the DL teacher broadcast from their school.

Student Reasons for Enrolling

Students were asked to identify their reasons for enrolling in the distance learning class. Reassuringly, 84% indicated they enrolled because they were interested in the subject. Sixty percent (60%) said it was the only way they could take the course--remember that some students were enrolled in sites of origin in which the class may have been offered traditionally as well as by distance learning. Thirteen percent (13%) said someone else had been responsible for them enrolling in the course, most usually a friend, superintendent, or principal. Eighty-six percent (86%) of the students indicated they would have enrolled if the class had been offered as a regular high school course.

TABLE 3: Students' Reasons for Enrolling in the Distance Learning Course

	% of Students Responding	
	Yes	No
I was interested in the subject	84%	14%
It sounded exciting	75%	23%
It was the only way I could take the course	60%	37%
I needed it for college	45%	53%
I prefer DL over a regular class	16%	79%
I like working on computers	14%	34%
It wasn't my idea to enroll in the class... someone else persuaded me to enroll	13%	83%

Student Attitudes Toward Distance Learning

Seventy-nine percent (79%) said they would enroll in another distance learning course if given the opportunity; 20% said they probably would not enroll in another course; the remainder were undecided.

Distance learning students were asked to assess the difficulty level of the course compared to regular classes. Slightly over half of the students (56%) said it was about the same level of difficulty, while 10% felt it was easier and 34% felt it was harder.

Asked to assess the amount of homework given as compared to regular classes, 58% said the amount of homework was about the same, while 15% believed there was more homework and 28% believed there was less homework.

TABLE 4: Student Assessment of Course Difficulty and Amount of Homework

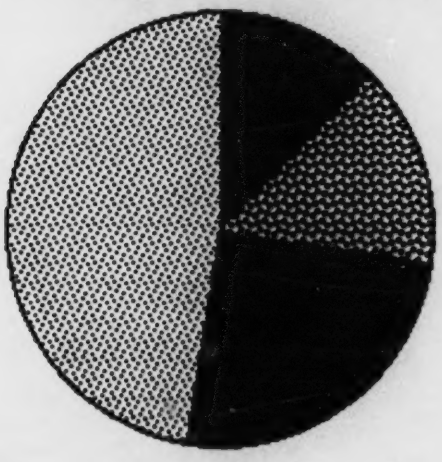
	Level of Difficulty of Course	Amount of Homework Given
	% Of Students Responding	% of Students Responding
Less than reg. class		27%
More than reg. class		15%
Same as reg. class		58%
Easier than reg. class	10%	
Harder than reg. class	34%	
Same as reg. class	56%	

Characteristics of Distance Learning Students

- Grade Level

The majority of students enrolled in distance learning classes were high school juniors (25%) or seniors (48%). The remaining 27% were evenly divided between 9th and 10th graders.

Diagram 1: Grade Level of Enrolled Students



Grade Level	% of Students
9th	12.5%
10th	14.8%
11th	25.1%
12th	47.6%

- Grade Categorization

All distance learning students were asked to categorize themselves as either an "A", "A-B", "C", or "D" student. The following table shows both how students categorized themselves and also how the school reported their grade point averages in the study.

TABLE 5: Student and School Categorization of Overall Student Grades

	As students reported	As school reported	
"A" Student	25%	39%	3.5-4.00 GPA
"A-B" Student	52%	22%	3.0-3.49 GPA
"C" Student	22%	29%	2.0-2.99 GPA
"D" Student	1%	10%	0.0-1.99 GPA

The only significant difference in categorization is the extent to which students undercounted themselves on both extremes, that is "A" students tended to lump themselves with "A-B" students and "D" students" tended to elevate themselves to "C" students. The breakdown of students, however, is probably fairly typical of the student body as a whole, perhaps with a slightly increased percentage of "A" students taking--or being steered into--distance learning courses.

Plans for College

Nearly all of the students enrolled in distance learning courses (95%) indicated that they planned on going to college, as might be expected given the nature of the courses offered.

Hours Spent Studying

Out-of-class time spent studying for the distance learning class was surprisingly low with 23% spending no time and 60% of the students spending 2 or fewer hours per week. Only 17% spent three or more hours studying per week.

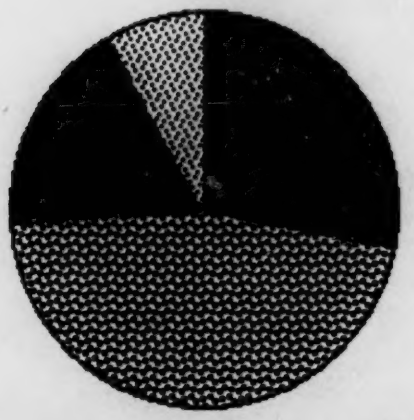
TABLE 6: Amount of Time Students Spent Studying for Distance Learning Classes

	Percent of Students
None	23%
1-2 hours per week	60%
3-5 hours per week	16%
6-10 hours per week	1%

Amount Learned

Students were asked their perception of how much they felt they had learned in the distance learning course. Perceptions were very positive with 74% indicating they had learned "a great deal" or "an acceptable amount". Eighteen percent (18%) said "not as much as I think I should have", while 8% said "not much at all".

Diagram 2
Student Perception of Amount Learned



Amount Learned	% of Students
A Great Deal	28.1%
An Acceptable Amount	45.6%
Not as much as I think I should have by now	18.1%
Not much at all	8.1%

Components of Class on Which Students Most Relied

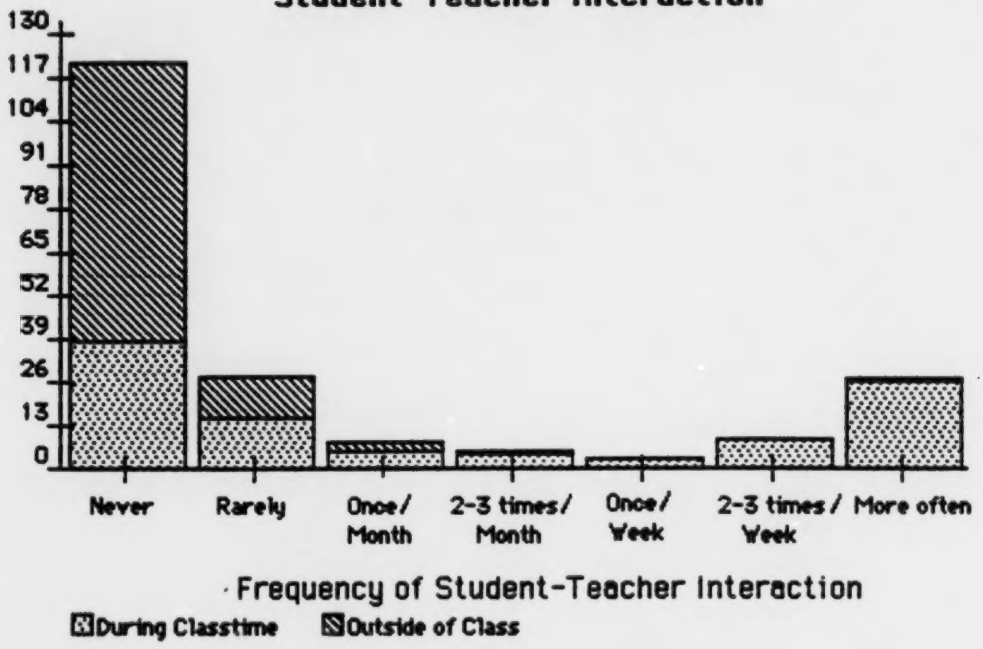
Textbooks were cited as the primary source of information by 39% of the students, while the TV classes were ranked first by 28% and workbooks/worksheets by 11%. Class or technology specific components, e.g., computer software/dialogue, Voice-Based Learning System, and audiotapes, ranked somewhat lower, as would be expected due to their more limited use.

Student-Teacher Interaction

The amount of student interaction with a teacher *during class time* differed greatly among students. Forty-three percent (43%) reported never or rarely interacting with the teacher, while 26% reported teacher interaction more than three times per week. (Method of interaction was obviously highly dependent on the type of the distance learning technology implemented.)

Outside of class time, student interaction with teachers was low, as would have been expected, but undoubtedly higher than in traditional classes. Seventeen percent (17%) of all students had some academic-related contact with their teacher outside of class time.

Diagram 3
Student-Teacher Interaction



Student Perception of Attributes Most Helpful in a D L Class

Interestingly, both an aptitude for or interest in technical equipment and an above average intelligence level were seen by students as *least* helpful in a distance learning class. More important in their estimation was the initiative to take responsibility for their own learning, a willingness to work on their own, and a high level of motivation.

TABLE 7: Characteristics Seen as Most Helpful by Students in a DL Class

	% of Students
Taking responsibility for my own learning	86%
A willingness to work on my own	82%
A high level of motivation	73%
An outgoing personality	61%
An interest in or aptitude for use of technical equipment	49%
An above average intelligence level	49%
Other	6%

Who Performs the Tasks Associated with Teaching in a DL Classroom

Students were given a list of tasks which might be the responsibility of the teacher in a traditional classroom. They were asked who, if anyone, performed those tasks in their distance learning class.

TABLE 8: Student Assessment of Who Performs Specific Tasks in a DL Class

	Teacher	Supervisor/ Coordinator	Students	Combi-nation*	No one	Not Applicable/ No Response
Motivates student to do well	48%	9%	15%	14%	13%	1%
Maintains discipline	45%	34%	7%	7%	6%	1%
Assists students with computer use	6%	7%	4%	4%	13%	66%
Assists students with modem or electronic mail	2%	23%	3%	2%	12%	58%
Encourages students to talk with or call the teacher	26%	16%	8%	11%	38%	1%
Assists students with software use	9%	11%	3%	2%	13%	63%
Operates the satellite receiving or camera equipment	10%	20%	23%	13%	4%	30%
Troubleshoots problems with equipment	14%	42%	11%	13%	14%	6%
Administers tests	34%	57%	1%	7%	<1%	1%
Grades tests	72%	11%	3%	13%	<1%	1%
Constructs quizzes or worksheets to assist student learning	76%	8%	1%	4%	10%	1%
Identifies and solves problems individual students may be having with the course	58%	10%	6%	12%	13%	1%
Learns the course material along with the students	NA	19%	--	6%	73%	2%
Participates or watches all classes along with the students	NA	33%	--	5%	61%	1%
Answers simple questions or helps students find answers to problems	49%	14%	9%	19%	8%	2%

The three primary tasks of the remote teacher or classroom coordinator, as assessed by the students, were administering/grading tests, constructing quizzes and worksheets, and maintaining discipline.

The students themselves were primarily responsible for operation of the equipment.

Of major importance, however, are the findings that 73% of the students report no one learning the course material along with them and 61% report that no one else participated in or watched all classes along with them.

ADMINISTRATOR DATA

Administrator Knowledge Of Distance Learning

Instate conferences and other administrators were the primary sources from which North Dakota administrators learned about distance learning technologies. Nearly half of all administrators gained information, however, from professional journals and/or instate demonstration projects.

TABLE 9: Source of Administrator Information about Distance Learning

	Percent of Administrators
Instate Conferences	70%
Talking with other Administrators	65%
Professional journals or publications	44%
Instate demonstration projects	44%
Technology Vendors or salespersons	30%
Out of state demonstration projects	26%
Out of state Conferences	13%
Other	9%

Thirty percent (30%) of the administrators initiating a distance learning program, however, explored no technology other than the one adopted. This is an important finding and strongly suggests the need for additional information which is readily and widely available to administrators.

Ninety-one percent (91%) of the administrators received outside technical or consulting assistance in selecting or setting up their distance learning program. The following table details the source of consulting services received:

TABLE 10: Source of Distance Learning Consulting Services

	% of Administrators Utilizing Consulting Services
Department of Public Instruction	55%
Equipment dealer or supplier	52%
Local telephone company	52%
Private Consultant	44%
Instate University or College	39%
Other	22%
Out of state University	9%

The types of assistance which districts received ranged from selecting out-of-state course providers to determining the technical equipment necessary for their particular technology. Given that all of the technologies utilized some type of technical eqipment, it is of particular interest that only 78% of the administrators indicated they (or someone in their school) had received training in the use of technical equipment.

TABLE 11: Types of Assistance Received by Schools Adopting a Distance Learning Technology

	% of Administrators Receiving Assistance
Determining the technical equipment necessary	93%
Actually setting up technical equipment	83%
Determining costs of implementing a distance learning course	82%
Gathering information on the technology	78%
Determining vendor sources for technical equipment	78%
Training in use of technical equipment	78%
Determining costs of implementing a distance learning course	82%
Training of local distance learning instructors	70%
Selecting course providers	39%

Existence of Technical Problems

While 70% of the administrators indicated they had encountered technical problems with the distance learning equipment installed, most prevalent was the existence of video problems (as indicated by 26% of the administrators) which were attributed to satellite dish positioning, distorted pictures, weak video signals, and satellite receiver controls. Audio problems, i.e., quality of phone lines and poor audio reception, accounted for 17% of the problems mentioned by administators. Other problems mentioned by single administrators included problems with computer software, loss of data, modulator/demodulator problems, and scheduling problems.

Fifty-two percent (52%) of the administrators--accounting for 75% of those having experienced technical problems--indicated that the technical problems had been resolved to their satisfaction, while 17% indicated that the problem(s) remained.

Future Use of Distance Learning Technology

Administrators were asked to anticipate how their current DL technology would be utilized next year and five years from now. A significant percentage (17%) believed their schools to be in jeopardy

within the next 5 years, but among other administrators all indicated a long-term growth in the role of distance learning technology.

Also of interest is the 30% of adminstrators who indicated they anticipated switching to a different DL technology with the next five years and the 78% who alluded to the use of multiple DL technologies within the same time span.

TABLE 12: Administrator Perception of Future Use of DL Technology in Their District

	% of Administrators	
	Next Year	Five Years From Now
The same courses will be offered	61%	48%
The number of courses will be expanded	70%	91%
A larger number of students will be served by DL	70%	78%
Other uses of the technology will be expanded to include:	83%	83%
Teacher Inservice	65%	74%
Community or business use	48%	65%
Administrative or interschool use	52%	65%
Student enrichment programming	57%	61%
We will likely switch to a different DL technology	0%	30%
We will likely use multiple DL technologies	44%	78%
We will likely not use any DL technologies	4%	4%
Our school may cease to exist	4%	17%

Lack of financial resources topped the list of impediments to greater use of distance learning among administrators in the future, however three-fourths of the administrators felt that state level policies and regulations would impede their increased use of DL technologies. Eighty-seven percent (87%) of the administrators saw distance learning as a long-term solution to curriculum expansion and limited teacher availability.

TABLE 13: Impediments to Greater Use of DL Technology in Their Own Districts in the Future (as Assessed by Administrators)

	% of Administrators	
	Yes	No
The limitations of the local district budget	94%	6%
Lack of outside funds to expand usage of distance learning technologies	88%	12%
The costs of equipment maintenance and upkeep	75%	25%
State level policies and regulations	75%	25%
The obsolescence of existing equipment	31%	69%
Lack of purchasable DL courses in needed subject areas	29%	71%
Lack of good teachers willing to become distance learning instructors	29%	71%
Cooperative hiring of teachers among districts will eliminate the need for it	13%	87%
The attitude of the school board regarding technology	12%	88%
Consolidation will eliminate the need for it	6%	94%
The need for distance learning courses will cease to exist	6%	94%
Teacher surpluses will eliminate the need for it	0%	100%

All administrators (100%) saw distance learning as serving a long-term need for curriculum expansion in small schools. Nearly all administrators saw it playing a significant role as a means of teacher inservice training (96%) and as a source for adult education or community use (91%).

TABLE 14: Administrator Perceptions of Purposes Served by Distance Learning Technologies

	% of Administrators		
	YES	NO	NR*
A long-term need for expanding the curriculum offerings of small schools	100%	--	--
As a means of teacher inservice training in small districts	96%	4%	--
As a source for adult education and for community use	91%	9%	--
As a source of supplemental course offerings for larger school districts	87%	13%	--
As a means for small schools to avoid or delay consolidation	35%	61%	4%
A short-term need for curriculum expansion until it becomes economically feasible to hire more teachers	17%	83%	--

* No Response Given

School/Community Attitude Toward Distance Learning

The superintendent (who generally was the administrator responding to the questionnaire) expressed the most positive attitude regarding the distance learning program implemented, as might be expected. Little direct opposition existed for the program--according to the administrator --except in isolated situations involving a counselor, a community, and two high school faculties.

TABLE 15: Administrator Perception of Attitudes Regarding Distance Learning in the School and Community

	Attitudes Regarding Local Distance Learning Program					
	Strongly Favorable	Favorable	Indifferent	Opposed	Strongly Opposed	NR
Your School Board	48%	52%	--	--	--	--
Superintendent	73%	27%	--	--	--	--
High School Principal	44%	52%	4%	--	--	--
High School Counselor	35%	44%	13%	4%	--	4%
High School Faculty	9%	52%	30%	9%	--	--
Course Supervisor	35%	44%	--	--	--	22%*
Course Instructor	65%	35%	--	--	--	--
Students Enrolled in DL course(s)	35%	61%	4%	--	--	--
Parents/Community Members	17%	65%	13%	4%	--	--

* The high rate of No Response among administrators on Course Supervisor attitudes undoubtedly reflects the lack of a supervisor or the limited role played by a supervisor in those schools.

Administrators expressed their own level of satisfaction with their distance learning program on several specific aspects. While 96% of the administrators indicated they were satisfied or very satisfied with the course overall, primary areas of dissatisfaction, to the extent that they existed, included the "fit" or alignment with existing school curriculum, the technical quality of the course, the cost, support from DPI, and access to technical support.

TABLE 16: Administrator Satisfaction With Distance Learning Program Components

	% of Administrators					
	Very Satisfied	Satisfied	Undecided	Dissatisfied	Very Dissatisfied	NR
Overall satisfaction with the program	48%	48%	4%	--	--	--
Selection of the course(s)	17%	61%	8%	4%	4%	4%
Content of the course(s)	30%	61%	9%	--	--	--
Quality of instruction	44%	52%	4%	--	--	--
Technical quality of course(s)	50%	41%	--	9%	--	--
Cost as compared to other alternatives	26%	39%	26%	9%	--	--
Level of difficulty for students	22%	74%	--	4%	--	--
Ease of supervision	39%	44%	13%	4%	--	--
Access to good technical support	26%	57%	9%	9%	--	--
Equipment upkeep and maintenance	32%	55%	9%	5%	--	--
Ease of equipment operation	39%	52%	4%	4%	--	--
Technical reliability of equipment	23%	59%	14%	5%	--	--
Support from DPI	14%	55%	23%	9%	--	--
Amount of knowledge students gain	26%	65%	9%	--	--	--
"Fit" or alignment with the traditional school curriculum	35%	48%	4%	13%	--	--

Factors Contributing to Decision to Adopt a Distance Learning Technology

Administrators were asked about which factors contributed to the decision to adopt their particular distance learning technology. Topping the list was the opportunity for curriculum expansion and the ability to offer courses with 1-2 students. The use of technology in education was a contributing factor for 83% of the administrators, but interestingly only 41% gave any importance to the existence of a video-based instructional medium. Clearly, most administrators (78%) saw other options potentially available to them, either through traditional means, e.g., shared teachers, or through other distance learning technologies. Twenty-two percent (22%), however, apparently saw no other option available to them, either because of their remoteness, (i.e., eliminating the possibility of a shared teacher or attraction of any teacher), their lack of knowledge of other distance learning technologies, or cost, (i.e., limiting their access to other distance learning technologies).

TABLE 17: Factors Contributing to School Decision to Adopt DL Program

	% of Administrators	
	Yes	No
Curriculum expansion opportunity for small schools	91%	9%
Courses could be offered with 1-2 students at any one site	91%	9%
Grant funds were available for it	87%	13%
Use of technology in education	83%	17%
It seemed to be a wiser long-term investment	74%	26%
Ability to drop or add a course from year to year	70%	30%
It seemed to be the most promising in terms of student learning	65%	35%
Overall flexibility of course(s)	65%	35%
The cost of the equipment	61%	39%
It was more affordable	57%	43%
Continuing costs other than equipment	48%	52%
Use of a video-based instructional medium	41%	59%
It was the only option available to us	22%	78%

Administrator Reservations Regarding Distance Learning

Now knowing what is involved with initiating and operating a distance learning course, all administrators (100%) said they would recommend their particular technology to other districts. Nearly half of the administrators (48%) indicated no major reservations or problems with their distance learning program. The other half of the administrators indicated problems with funding (27% of all administrators), scheduling problems or enrollment deadlines (13%), inability of technology to replace a "live" classroom (9%), technical problems (4%), state regulations regarding course supervision (4%), lack of knowledge of classroom supervisor (4%), not enough live interaction with teacher (4%), and facilities for continued use and expansion (4%).

Basis for Student Enrollment

Administrators were asked to indicate the basis on which students were allowed to enroll in their distance learning courses. Seventy percent (70%) indicated that no restrictions were placed on student enrollment in distance learning courses, however, it is obvious that upper grade level students were steered into DL courses. Students were not routinely included or excluded on the basis of ability or motivation level, as indicated by the administrator responses. Only one-fifth of the schools selected students on the basis of perceived ability and one-third on the basis of student motivation levels.

TABLE 18: Basis for Distance Learning Student Enrollment

	% of Administrators
Student selection based on their grade level	57%
Students selection based on GPA or perceived ability level	22%
Student selection based on student motivation level	35%
No restrictions placed on student enrollment	70%

Modification of School Bell Schedule or Calendar

Nearly two-thirds (65%) of the schools did modify their school calendar to accomodate the distance learning class(es), while 61% modified their bell schedule. Similar percentages responded to how seriously they saw the need for identical class (bell) schedules and school calendars among consortium adopters.

TABLE 19: Importance Attributed to Common Bell Schedules and School Calendars by Administrators in DL Schools

	% of Administrators	
	Common Bell Schedules	Common School Calendars
Must Adopt	35%	35%
Should Adopt	39%	35%
Not Sure	9%	13%
Probably Not Necessary	17%	17%

Administrator Perception of Criteria Considered Necessary for Successful Implementation of a Remote DL Program

Most striking with respect to administrator perceptions about criteria needed for successful program implemention is the extent to which administrators, lacking any research data, rely on their skepticism of state regulations and ease of implementation practices in laying out the criteria for successful program implementation. Administrator perceptions of such criteria do not necessarily coincide with the criteria found in the study to be most related to student success.

Certainly this demonstrates a need for solid research data to be made available to persons in a position of initiating or carrying out distance learning programs. For example, 35% of the administrators did *not* see the purchase and implementation of all intended course components to be critical to program success; research data shows,

however, that elimination of intended course components clearly relates to increased student frustration, decreased student motivation, and a higher severity level of student-identified problems associated with the course.

TABLE 20: Administrators' Criteria for Successful Program Implementation

	% of Administators	
	Yes	No
A course instructor certified in the subject matter taught	74%	26%
All students enrolled in a live rather than taped course format	70%	30%
The purchase and implementation of all intended course components	65%	35%
The capability of continuous live interaction with the instructor	57%	43%
A supervisor who is available to monitor the class electronically	52%	48%
The capability of intermittent live interaction with the instructor	48%	52%
A coordinator or supervisor present in remote classrooms at all times	44%	56%

Administrator Perception of Role of State Education Agencies in DL

Administrators were asked whether each of the following activities *should*, in their opinion, be carried out by the State Department of Public Instruction. The degree to which they "Strongly Agreed", "Agreed", were "Undecided", "Disagreed", or "Strongly Agreed" with each potential state agency activity was recorded. Activites were ranked according to the combined percentage of administrators who "Strongly Agreed" or "Agreed" with each activity.

Of primary interest is the second and third ranked activities. While all (100%) of the administrators agreed with the state department's traditional role of administering technology grant funds, 92% of the administrators believed that state education agencies should provide districts with cost and vendor information and collect evaluation information from adopting districts for distribution to other districts. This is particularly insightful, indicating perceived administrator need for and receptivity to technical and research information on distance learning technologies.

TABLE 21: Administrator Reaction to Potential State Education Agency Activities

	Rank*	% of Administrators SA	A	U	D	SD
Administering technology grant funds to applicant districts	1	74%	26%	--	--	--
Providing technical assistance to school districts implementing DL programs	4	52%	35%	9%	4%	--
Setting accreditation standards for DL courses	9	35%	35%	17%	9%	4%
Providing school districts with cost and vendor information for courses and technical equipment	2	35%	57%	9%	--	--
Accrediting providers of national DL courses	8	30%	44%	22%	--	4%
Providing inservice training for DL instructors	7	27%	50%	14%	9%	--
Evaluating DL course content for accreditation purposes	6	23%	55%	9%	9%	5%
Collecting evaluation information from adopting districts in order to share with other districts	3	22%	70%	4%	4%	--
Establishing standards for supervision of remote students	10	13%	57%	13%	4%	13%
Monitoring school districts for compliance with DL course implementation standards	5	9%	73%	5%	9%	5%

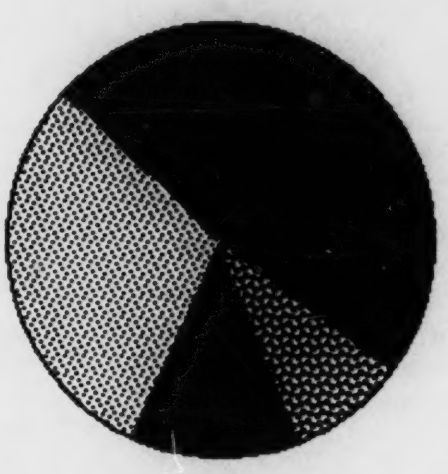
* Rank is based on the combined percentage of administrators responding to "Strongly Agree" and "Agree".

CLASSROOM COORDINATOR/SUPERVISOR DATA

Employment Data on Classroom Coordinators/Supervisors

Persons serving as distance learning coordinators or classroom supervisors most often held another position within the school district and were not hired specifically to cover the distance learning coordinator role. Only 13% of the coordinators were specifically hired part-time as DL classroom supervisors ; 35% were teachers in the school; 9% were administrators who also taught; 13% were full-time administrators; and 30% were staff persons with the school. Staff persons included computer lab coordinators, study hall supervisors, teacher aides, and librarians.

Diagram 4
Other Positions Held by DL Supervisors



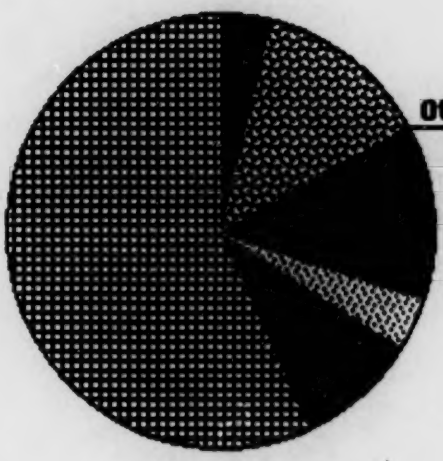
Other Positions Held	% of Coordinators
Teacher	35.0%
Teaching Administrator	9.0%
Full-time Administrator	13.0%
Staff Person	30.0%
DL Supervisor only	13.0%

Forty-four percent (44%) of the coordinators taught other traditional courses in the school for an average of five additional class periods. Two teachers (9%) apparently taught 7 other class periods in addition to--or more likely, simultaneously with--supervising the distance learning class.

Diagram 5
Number of Other Classes Taught

Number of Other Classes	% of Coordinators
1	4.0%
3	9.0%
4	17.0%
5	9.0%
7	4.0%
Do not teach	57.0%

Diagram 6
Number of Other Class Periods Taught



Number of Other Class Periods	% of Coordinators
1	4.0%
4	13.0%
5	13.0%
6	4.0%
7	9.0%
Do not teach	57.0%

Only 22% of the DL Supervisors received extra compensation for their supervisory duties, while 52% indicated that there were other duties which they simultaneously performed during the DL class, e.g., noon-duty supervision, substitute teaching, computer lab assistance, study hall supervision, library duties, teaching, administrative or "paper" work, correcting papers, or preparation for other classes.

Seventy-four percent of the DL supervisors just completed their first year in the position; 9% had been in the position for more than 2 years.

Knowledge and/or Experience Level of DL Coordinators/Supervisors

DL Coordinators were asked to rate their own level of knowledge or experience with each of the following *prior* to serving as a DL coordinator or supervisor. A major finding is that DL Coordinators were, in the majority of schools, not selected for any particular experience with or knowledge of either the subject matter or equipment utilized. Apart from tape recorders, classroom management skills, and VCR's, previous experience with computers was highest among DL Coordinators. Slightly more than half (59%) of the coordinators of DL courses utilizing computers had a moderate or greater knowledge of computers prior to the course. Knowledge of course content and modems was least prevalent with only 17% and 14% of the applicable coordinators having moderate or greater knowledge of them, respectively.

TABLE 22: Knowledge/Experience Level of DL Coordinators/Supervisors

	% of DL Coordinators						% of Applic.
	None	Very Little	Some	Moderate Amount	Great Deal	Not Applic.	Coord. w/ Mod.or Greater Experience
Tape recorders	--	--	13%	39%	35%	13%	85%
Classroom management skills	--	9%	13%	26%	52%	--	78%
VCR's	--	--	26%	39%	26%	9%	71%
Use of computers	9%	17%	4%	30%	13%	26%	59%
Computer software use	13%	13%	17%	22%	17%	17%	47%
Speaker telephones	17%	35%	--	17%	4%	26%	29%
Satellite receiving equipment	30%	17%	4%	9%	4%	35%	20%
Knowledge of subject matter	48%	22%	13%	13%	4%	--	17%
Modems	39%	--	13%	4%	4%	39%	14%

Training of DL Supervisors

Fifty-two percent (52%) of the Distance Learning Supervisors indicated they had received training in that role. Length of training ranged from less than 1 hour to 2 days, with an average training length of 1/2 day. Training was performed by six different entities for the twelve supervisors who indicated that they had received training--among them a North Dakota State University credit course, a training session by satellite, Mayville State University personnel, and the local superintendent.

The type of training received is listed in the table below along with the percent of coordinators for whom such training would have been pertinent based on the particular DL technology in which they were involved.

TABLE 23: Type of Training Received as DL Coordinator/Supervisor

	% Receiving Training	% of Coordinators to Whom Training Would Have Been Pertinent
Satellite equipment operation	30%	43%
Video equipment operation	26%	39%
Computer operation	26%	57%
Modem operation	13%	43%
Role of the supervisor in the classroom	30%	100%
Other	4%	--

Forty-four percent (44%) indicated that they had received written guidelines concerning their DL supervisor role.

Sources of Technical Assistance

Coordinators were asked to whom they would turn for assistance if technical problems arose in the distance learning course. Although 17% listed no source of assistance, 61% of the coordinators indicated one source and 23% listed two sources. Among the sources given were the satellite course provider (TI-IN or SERC), the course instructor, Prairie Public TV, the superintendent or principal, the computer teacher, the course facilitator, Mayville State University personnel, or the Department of Public Instruction.

Coordinator Perception of Qualifications Necessary in the Role

There was nearly universal acceptance of the need for a classroom supervisor, at least among the coordinators. The concensus, however, stopped there. There was no uniform agreement on whether the role should be filled by a teacher, an administrator, or other staff. Seventy percent (70%) did feel that the coordinator should be present in the classroom at all times and 65% believed the coordinator should have some knowledge of the subject matter.

TABLE 24: Coordinator Perceptions of Qualifications Necessary in the Role

	% of Coordinators Agreeing With Statement	
	Yes	No
Should be a certified teacher in the subject matter of the class	22%	78%
Should be a certified teacher in some subject area	44%	56%
Should be a certified teacher at the secondary level	48%	52%
The role can be adequately handled by the superintendent, principal, counselor, or other professional employee	61%	39%
The role can be adequately handled by non-professional staff	44%	56%
Should have some knowledge of the subject matter being taught	65%	35%
Should be present in the classroom at all times	70%	30%
There is no need for a classroom facilitator or supervisor	4%	96%

Location of Distance Learning Classroom

More than two-thirds (74%) of the classrooms had been rooms which were remodeled or adapted for use as a DL classroom. Thirteen percent (13%) of the classes were held in regular classrooms; another 13% were held in an office or other non-classroom. The remainder were located in a library/media center, computer lab, or new room built for I-TV.

Videotaping of Distance Learning Class

Fifty-seven percent (57%) of the DL classes are routinely videotaped for students who are absent from class, 39% for student review purposes, 30% for delayed broadcast to students, and 13% for self-critique of teacher performance in I-TV classes.

Other Utilization of Distance Learning Equipment

According to the classroom coordinators/supervisors, only 13% of the schools do *not* use their DL equipment for other purposes. Among the auxiliary uses of the equipment are student enrichment programming (30%), community use (48%), business use (9%), sports scheduling among schools (13%), administrative discussions/conferences (43%), and teacher inservice training (54%).

TABLE 25: Auxiliary Uses of Distance Learning Equipment

	% of Schools
Teacher inservice training	54%
Community use, e.g., adult education	48%
School administrator discussions/conferences	43%
Student enrichment programming	30%
School sports scheduling among schools	13%

Coincidence of Class (Bell) Schedule with DL Broadcast Schedule

Only 30% of the coordinators reported that their school's class (bell) schedule coincided perfectly with the DL class schedule. Among those 30%, less than half (43%) reported that the bell schedule had been altered to accomodate the DL schedule.

Among the 70% of the schools whose bell schedules did not coincide with the DL class schedule, however, 63% of the coordinators reported that students are released early or admitted late from other classes in order to participate in the entire DL class. In 22% of the schools, students missed up to 10 minutes of the DL class because of overlap with other classes.

Seventy percent (70%) of the coordinators did believe that schools participating together in distance learning courses should adopt identical bell schedules; 49% believed that non-synchronized school calendars among schools participating together in DL courses present a significant problem.

Number of Computers Available to DL Students During Class Time

Sixty-one percent (61%) of the coordinators reported that a computer is not used in their DL classroom. Among the 39% of the classes in which computers are used, the following table details the number of computers available for students during classtime.

TABLE 26: Number of Computers Available to DL Students During Class Time

	% of Total Schools
None	4%
One	17%
Two	4%
Six	9%
Fourteen	4%
	39%

Duties Performed by Classroom Coordinators or Supervisors

- Homework/Test grading

Sixty-one percent (61%) of the coordinators reported that all homework and tests are graded by the remote course instructor; 35% indicated that grading is shared by the instructor and themselves; 4% indicated that the coordinator grades all homework and tests.

- Student Feedback

Seventy-four percent (74%) of the coordinators felt that students receive feedback from homework and tests quickly enough, while the remaining 26% cited problems with delays in remote teacher feedback to students.

- Extent of Coordinator Participation in the DL Course

Twenty-two percent (22%) of the coordinators reported that they are involved in instruction in the DL course, but even among those 22%, their instructional role is minimal. Instructional activities in which the six coordinators reported participation include bringing in pertinent materials to the class, organizing class socials, discussing/reviewing/ troubleshooting, running off worksheets and tests, or preparing additional worksheets for students.

Coordinator Perception of Amount Learned by DL Students

DL Coordinators were asked to indicate their impression of the amount learned by students for each DL class they supervised. They were asked to rate each class on a four point scale, using four descriptors-- "learned a great deal", "learned an acceptable amount", "didn't learn as much as I think they should have", "didn't learn much at all". The following table shows the coordinators' average rating for all classes within each technology as well as for each class within each technology.

Digital Interactive TV had the highest coordinator rating, with TI-IN by Satellite and Analog Interactive TV following closely behind. OSU Instruction by Satellite was last in terms of coordinator perception of amount learned by students. It should be kept in mind, however, that inadequate implementation of all course components with Instruction by Satellite in some schools is probably the major contributing factor to the low coordinator rating.

TABLE 27: Coordinator Rating of Amount Learned by Students (by Technology and by Class)

Technology	Average Coord. Rating by Technology	Class	Average Coord. Rating by Class
Digital I-TV	3.7	Art	4.0
		Speedwriting	3.8
		Spanish I	3.5
TI-IN (Sat)	3.6	Art	4.0
		French	4.0
		Latin	4.0
		Spanish I	4.0
		Japanese	2.0
Analog I-TV	3.5	US History	4.0
		Adv. Biology	4.0
		German I	3.7
		Spanish I	3.5
		Accounting II	3.0
		Anatomy/Physiology	3.0
		Child Development	3.0
Audiographic	3.3	Spanish I	3.3
SERC (Sat.)	3.2	Japanese	3.5
		Russian I	3.4
		Probability/Statistics	3.0
		Micro Economics	2.5
OSU (Sat.)	2.8	German I	3.0
		German II	2.5

Coordinator Comparison of Distance Learning vs. Traditional Courses

Coordinators were also asked to compare distance learning courses utilizing their particular technology with a regular class in the same subject. Little concensus existed among coordinators, however, except when broken down by technology. Instruction by satellite coordinators were much more likely to believe that DL students learn less than they would in a traditional class. Both Instruction by Satellite and Audiographic Coordinators were much more likely to believe that DL students are frustrated by not having a subject-knowledgeable teacher in the classroom and that DL students do not want to put forth the effort required of them as compared to traditional students.

TABLE 28: Coordinator Comparison of Distance Learning with Traditional Classes

Remote-site DL students generally:	% of Coordinators					
	Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree	NR
Learn less than they would in a regular class	8.7	17.4	17.4	17.4	34.8	4.3
Are frustrated by not having a subject-knowledgeable teacher in the classroom	13.0	17.4	13.0	8.7	39.1	8.7
Do not want to put forth the effort required	8.7	26.1	8.7	17.4	34.8	4.3

Coordinator attitudes concerning some issues about distance learning did not vary as much by technology. Nearly half (48%) of all coordinators felt that DL courses give students the opportunity to learn more than they may in a traditional class. Audiographic coordinators, however, were more likely to display some skepticism about the technology's learning potential. The majority of coordinators across all technologies generally agreed that distance learning is the only viable alternative for expanding their curriculum and that a DL course is preferrable to no course at all. Some Instruction by Satellite Coordinators, however, disagreed with the preference of a DL course over no course at all, further expressing their frustration with the technology as implemented.

TABLE 29: Coordinator Attitudes Toward Distance Learning Classes

Distance Learning courses:	% of Coordinators					
	Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree	NR
Give students the opportunity to learn more than they may in a traditional class	21.7	26.1	30.4	8.7	4.3	8.7
It is the only viable alternative for expanding our curruculum	30.4	34.8	8.7	13.0	4.3	8.7
Is preferrable to no course at all	69.6	8.7	4.3	--	8.7	8.7

Coordinator Perception of Why Students Dropped from Course

Sixty-five percent (65%) of the coordinators indicated their school's policy allowed students to drop a distance learning course once enrolled. Fifty-seven percent (57%) of the coordinators said there were students in their classes who *did* drop the course. The coordinators' perceptions of why students dropped are detailed in the following table:

TABLE 30: Coordinator Perception of Why Students Dropped the DL Course

	% of Total Coordinators in Agreement	% of Coordinators in Agreement Who Had Students Drop
Students felt the course was too difficult	30%	54%
Students were not motivated to learn	30%	54%
Students were concerned about grades, e.g., their GPA or class rank might suffer	17%	31%
Students were uncomfortable with a DL format	17%	31%
Students felt too much was expected of them	13%	23%
Students could not quickly get answers to questions	13%	23%
Students felt they were not learning	9%	15%
Students were frustrated by not having a teacher physically present in the classroom	9%	15%
Students were frustrated with the technology	4%	8%
Conflicts with the instructor or coordinator	0%	0%

Coordinator Assessment of Who Performs Specific Tasks in the DL Class

Of primary interest is the extent to which the coordinators believed that the majority of classroom tasks were being handled by someone. Clearly, however, the majority of coordinators did not see most of the tasks as their responsibility. With 59% of the coordinators *not* watching or participating in the classes, it is clear that students were being expected to "do it on their own".

TABLE 31: Coordinator Assessment of Who Performs Specific Tasks in a DL Class

	Teacher	Supervisor/ Coordinator	Students	Combination*	No one	Not Applicable/ No Response
Motivates student to do well	68%	14%	--	18%	--	--
Maintains discipline	32%	41%	--	27%	--	--
Assists students with computer use	5%	18%	--	9%	--	68%
Assists students with modem or electronic mail	--	36%	--	5%	--	59%
Encourages students to talk with or call the teacher	41%	36%	--	18%	5%	--

(Table continued on next page)

Coordinator Assessment of Who Performs Specific Tasks in a DL Class, Cont.

	Teacher	Supervisor/ Coordinator	Students	Combi-nation*	No one	Not Applicable/ No Response
Coordinates use of software to insure use of each by all students	5%	14%	--	--	9%	73%
Operates the satellite receiving or camera equipment	5%	32%	5%	32%	--	27%
Troubleshoots problems with equipment	9%	68%	--	14%	5%	5%
Administers tests	32%	64%	--	5%	--	--
Grades tests	73%	9%	5%	9%	5%	--
Constructs quizzes or worksheets to assist student learning	77%	--	--	--	23%	--
Identifies and solves problems individual students may be having with the course	55%	18%	--	14%	14%	--
Learns the course material along with the students	--	18%	--	9%	78%	--
Participates or watches all classes along with the students	--	41%	--	--	59%	--
Answers simple questions or helps students find answers to problems	32%	36%	5%	27%	--	--

Coordinator Assessment of Improvements Needed in the DL Course(s) or Technology Involved

Sixty-three percent (63%) of the coordinators said they felt there were aspects of the course or technology which needed improvement. Forty-eight percent (48%) felt the problems were "Tolerable", 30% felt they were "Serious", and 22% said they were "Severe".

Problems most frequently cited by the coordinators were technical problems (33%) and problems with communication or student feedback (30%). Among the three technologies and six originators of DL courses, SERC (Satellite) coordinators listed far more problems than did coordinators at other sites. Nearly half (48%) of all problems listed were at SERC sites.

TABLE 32: Problems Listed by DL Coordinators

	Interactive TV		Satellite			Audiographic Telelearning	
	Analog	Digital	TI-IN	OSU	SERC		
(# of DL Coord. responding)	(6)	(4)	(2)	(3)	(5)	(2)	
	Percentages Reflect % of All Problems Listed						TOTAL
Technical problems	7%	7%			15%	4%	33%
Communication/Student feedback problems					26%	4%	30%
Scheduling problems	7%		4%				11%
Quality of instruction/Not all teachers belong on system	4%			4%			8%
Classes should be more elective		4%					4%
Making up work is hard			4%				4%
Inservice quality and management					7%		7%
Keeping students on task						4%	4%
	18%	11%	8%	4%	48%	12%	100%

INSTRUCTOR DATA

Unlike Instruction by Satellite, Interactive Television and Audiographic Tele-learning classes originate from within a cluster of schools most usually within a geographically proximate area. The number of schools (and therefore students) who participate in any one class is limited by the ability to interact with the remote teacher via the technology. Indeed, to extend the number of schools who participate in any one class beyond 4-5 with Interactive TV and 5-7 with Audiographic Tele-learning effectively negates the real advantage of the technologies--the ability to involve all students interactively with the teacher.

Twelve teachers--five in Digital I-TV, six in Analog I-TV, and one in Audiographic Tele-learning--comprise the teacher cadre involved in distance learning courses in North Dakota. Digital I-TV classes taught include Advanced English, Art I, Shorthand/Speed Writing, Spanish I, and Accounting III. Analog I-TV classes taught are Spanish I, Psychology/US History, German I, Anatomy/Physiology, Accounting II, and Parenting/Child Development. The Audiographic Tele-learning project involves only Spanish I.

The twelve teachers representing ten districts differ from their Instruction by Satellite counterparts in several respects, the most obvious of which is their location in and tie to a local school district. Instruction by Satellite teachers generally teach to a national audience with spontaneous audio-interactive capabilities limited to only a very small proportion of the hundreds of students watching the live course. In some cases, other capabilities, such as electronic keypad and electronic mail attempt to compensate for the lack of immediate student-teacher interaction.

Teaching Experience of DL Instructors

The majority of DL teachers had extensive prior teaching experience. Three-fourths of the teachers had 11 or more prior years in the teaching profession. Only 1 teacher had 2 years or less experience and two teachers had between 3 and 5 years' experience.

Of the nine teachers with 11 or more years' experience, five had been in their current district 11 or more years; three had been employed in the current district for 6-10 years.

Teaching Schedule

Nine of the twelve teachers (75%) were full-time teachers in their home district with either a six- or seven-hour teaching load including prep hour. One DL class was taught by a superintendent who also taught two hours per day and one was taught by a teacher holding a part-time position with the district.

Time Allotments

Time devoted to preparation and teaching of the distance learning classes can be seen in the table below. Of significance is that three-fourths (75%) of the DL teachers spent three or more days prior to the beginning of the school year preparing for the DL class. Fifty percent (50%) of the DL teachers devoted six or more hours per week during the school day to the DL class and one third (33%) spent six or more hours per week after school hours on DL class preparation. Clearly, involvement in the DL class exacted a time toll--at least for the first year-- on those teachers involved..

TABLE 33: Distance Learning Teacher Preparation Time

	% of DL Instructors		
Amount of Time Devoted to DL Class	Prior to the beginning of the school year	During the school day	After school hours
0 days	25.0%		
3 days	16.7%		
6 days	8.3%		
10 days	25.0%		
14 days	16.7%		
15 days	8.3%		
	100%		
Less than 2 hrs/wk		8.3%	33.3%
2-5 hrs/wk		41.7%	33.3%
6-10 hrs/wk		33.3%	25.0%
More than 10 hrs/wk		16.7%	8.3%
		100%	100%

Teachers were evenly split with respect to the point at which they became involved in the distance learning class. Half became involved in the early planning stages of the project; half became involved later as instructors were being identified.

Sources of Technical Assistance for DL Teachers

Half of the DL teachers (50%) indicated they could turn to a single source for assistance if/when technical problems arose. In the case of the Interactive TV teachers, that source was either the telephone company, the technical consultant hired by the consortium or a local administrator. The instructor in the Audiographic Tele-learning project felt he could turn to the author of the computer program being used in the technology. Two additional instructors felt there were two sources of assistance upon which he/she could rely--the telephone company plus the technical consultant or local administrator. One-fourth of the instructors did not indicate a source of assistance available to them.

Problems Identified

Three-fourths (75%) of the teachers indicated that there had been problems that occurred early in the course but that they had now been resolved for the most part. The remaining one-fourth (25%)--2 Analog I-TV and 1 Digital I-TV teachers--indicated no technical problems had arisen during the course.

Teacher Knowledge or Experience with Various Technologies

Teachers were asked to rate their own knowledge of or experience with each of several technologies prior to becoming involved with the DL course. Their responses are detailed in the table below. Of particular interest is the relative technological inexperience of the DL teachers. One third had used computers very little or not at all. Half or more had never used modems, satellite receiving equipment, speaker telephones, or fax machines. Indeed, VCR's and tape recorders were the only two pieces of equipment listed which had been widely used, i.e., a "moderate amount" or a "great deal".

TABLE 34: Level of Technological Knowledge or Experience of DL Teachers

	None	Very Little	Some	Moderate Amount	Great Deal	TOTAL
Use of computers	8%	25%	--	42%	25%	100%
Modems	58%	17%	--	17%	8%	100%
VCR's	--	--	--	67%	33%	100%
Satellite receiving equipment	67%	8%	17%	--	8%	100%
Computer software use	8%	17%	8%	42%	25%	100%
Tape recorders	17%	--	--	42%	42%	100%
Speaker telephones	50%	25%	25%	--	--	100%
Videocameras	17%	--	42%	33%	8%	100%
Fax machines	58%	25%	--	17%	--	100%

DL instructors were rated on their "technological expertise" by calculating their composite score for knowledge of the nine pieces of technical equipment. The scale range was 0 to 36 with 0 signifying no knowledge of any of the equipment and 36 signifying a "great deal" of knowledge of or experience with each piece of equipment. Actual composite scores ranged from 5 to 29 and average technological experience scores ranged from .6 to 3.2. As can be seen in the following graph, the amount of technological knowedge or experience was minimal among the bulk of the DL instructors with 8 of the 12 instructors scoring an average of 2.0 or less.

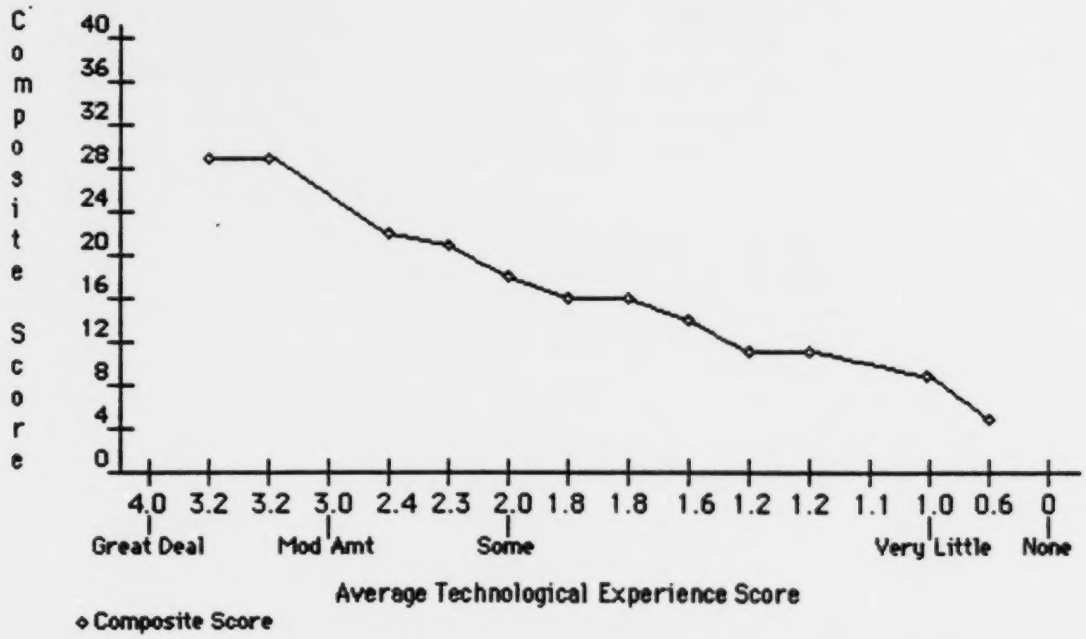


DIAGRAM 7: Technology Experience "Scores" of Individual DL Instructors

Distance Learning Instructor Training

All DL instructors received training through either a Valley City State University (North Dakota) course, a teacher from the Battle Lake, Minnesota Interactive TV Project, the local telephone company, or the Pennsylvania developers of the Audiographic Tele-learning system.

The amount of training received ranged from 6 to 35 hours with Analog I-TV instructors all receiving 18 or more hours training and Digital I-TV instructors all receiving between 6-14 hours training. The Audiographic Tele-learning instructor reported having received 10 hours of training.

As can be seen in the table below, both Analog and Digitial I-TV instructors received training in equipment operation and practice teaching using the technology, however the Audiographic instructor received training in only the computer software used. In addition three Digital I-TV instructors mentioned other training received, e.g., use of suitable visuals, proper teaching techniques, and classroom organization.

TABLE 35: Type of Training Received by DL Instructors

	% of DL Instructors Receiving Training		
	Analog I-TV	Digital I-TV	Audiogr.Tele-learning
Equipment operation	100%	100%	0%
Computer software used	NA*	NA*	100%
Organizing the curriculum	17%	20%	0%
Practice teaching using the technology	100%	80%	0%
Other:			
Use of suitable visuals		20%	
Proper teaching techniques		20%	
Classroom organization		20%	

* Not applicable to that technology

Comparison of Traditional vs. DL Teaching Roles

DL instructors were asked to describe the difference between their role as a teacher in the distance learning class and their role as a teacher in a regular classroom. Three-fourths (75%) of the DL instructors saw little difference in carrying out the two roles, but half (50%) felt that teaching is more exciting in a distance learning class and two-thirds (67%) felt they could teach "better" utilizing the educational technology. All (100%) disagreed that discipline is more of a problem in a DL class.

Two-thirds of the DL instructors did believe that there is less student-teacher interaction in a DL class and that it is more difficult to know if their students in a DL class understand what they are teaching.

TABLE 36: DL Instructor Comparison of Traditional YS. DL Teaching Roles

	% of DL Instructors in Agreement with Statement
There is little difference between the two roles	75%
Each requires a different teaching style	67%
It is more difficult to know if your students in a distance learning class understand what you are teaching	67%
There is less interaction between teacher and students in a distance learning class	67%
Discipline is more of a problem in a distance learning class	0%
Teaching is more rewarding in a distance learning class	25%
Teaching is more exciting in a distance learning class	50%
I feel I can teach "better" utilizing the educational technology in the distance learning class	67%

Use of a Written Curriculum

Three-fourths (75%) of the DL instructors indicated that they use a written curriculum with learning objectives in both their traditional and DL classes.

Essential Attributes of DL Instructors

Each DL instructor was asked to identify, in their opinion, the essential attributes of a distance learning instructor. All (100%) agreed that flexibity, organizational skills, and an outgoing personality are needed, while less than half (42%) felt that an expertise in the technology was essential.

TABLE 37: Essential Attributes of DL Instructors

	% of DL Instructors Identifying Attribute
Flexibility	100%
Organizational skills	100%
An outgoing personality	100%
An exceptional command of the subject matter	75%
Expertise in technology	42%
Other:	
Exceptional writing and speaking skills	8%
Willingness to work more	8%

DL vs. Traditional Curriculum

Most North Dakota DL instructors (75%) indicated that the curriculum followed in the DL course did not differ from that of a traditional class in the same subject matter; one fourth believed they cover less material and that the material is covered more slowly in a DL class. From the DL instructor's point of view, the Audiographic Tele-learning class only differed from a traditional curriculum in terms of greater reliance on the textbook, while differences among Interactive TV classes appeared to be much more dependent upon the individual teacher.

TABLE 38: DL Instructor Comparison of DL vs. Traditional Curriculum

	% of DL Instructors in Agreement with Statement			
	Analog I-TV	Digital I-TV	Audiogr. Tele.	Total
The curriculum does not differ; I cover essentially the same material at the same pace	83%	60%	100%	75%
I rely more on the textbook in the DL class	17%	0%	100%	17%
I use more worksheets in my DL class	0%	20%	0%	8%
I use more tests and/or quizzes in my DL class	17%	0%	0%	8%
I seem to cover material more slowly in the DL class	17%	40%	0%	25%
I seem to cover less material in the DL class	17%	40%	0%	25%
I can expose students to a wider array of information through the use of technology	83%	40%	0%	58%

Methods of Homework and Test Transmission in DL Classes

Several methods of homework and test transmission were utilized in the DL classes, including mail, FAX, courier, videocamera, and computer. While the methods employed were many, most notable was the combination of methods most districts used to transmit tests, quizzes, worksheets, notes, and homework assignments both to and from the students.

TABLE 39: Methods of Transmission of Homework and Tests

	# of Sites Using Each Method of Transmission				
	Mail	FAX	Videocam	Courier	Computer
Tests/quizzes sent to remote students	10	10	2	3	0
Worksheets/notes sent to remote students	9	7	2	3	1
Tests/quizzes returned to instructor	11	1	0	3	0
Homework assignments returned to instructor	12	1	2	4	0

Turnaround time with respect to transmission of tests and homework was a concern expressed by one-fourth of the DL instructors. Only two Digital and one Analog I-TV instructor said they were *not* satisfied with the turnaround time. Turnaround time was reported to range from 2-3 days to more than eight days, with 64% of the I-TV instructors indicating a usual 2-3 day turnaround time.

DL Instructor Contact with Students Outside of Class Time

Seven of the twelve DL instructors (58%) indicated that provisions are made for students to reach them outside class time. Frequency of student contact outside class time is detailed in the table below:

TABLE 40: Frequency of Out-of-Class Contact Between DL Students and Teachers

	% of Instructors							
	Never	Rarely	Once/ Month	2-3 Times Month	Once/ Week	2-3 Times Week	More Often	Total
By telephone	50%	33%	--	8%	8%	--	--	100%
Over the Interactive TV network	58%*	25%	--	8%	--	8%	--	100%
Over the Audiographic system	92%**	8%	--	--	--	--	--	100%
By electronic mail	83%	17%	--	--	--	--	--	100%
By regular mail	67%	25%	8%	--	--	--	--	100%

* Not available to Audiographic Tele-learning schools

** Not available to Interactive TV schools

Analog I-TV instructors were much more likely to have some contact with their students outside of class time than were Digital I-TV instructors, although frequency of contacts was not great in either case. The Audiographic instructor indicated out-of-class contact between the students and himself occurred rarely; methods of contact were by telephone, over the Audiographic system, and by regular mail.

TABLE 41: Incidence of Out-of-Class, Student-Teacher Contact by Technology

	% of DL Instructors Indicating Any Out of Class Contact with Students by Technology Adopted		
	Digital I-TV	Analog I-TV	Audiogr.Tel.
By telephone	20%	67%	100%*
Over the I-TV network	20%	67%	--
Over the Audiographic system	--	--	100%*
By electronic mail	0%	33%	0%
By regular mail	20%	33%	100%*

* Based on the single Audiographic Tele-learning instructor's responses

Instructors' Opinions of Qualifications Necessary for a Supervisor in a Distance Learning Classroom

Supervision of remote classrooms is a topic of continuing debate. In the opinion of the DL instructors of Interactive TV and Audiographic Tele-learning, three-fourths believed that the supervisor role could be adequately handled by either a professional employee, e.g., superintendent, principal, counselor, etc., or by a non-professional employee, e.g., secretary, aide, etc. More than half (58%), however, felt electronic supervision of the students was sufficient, while one-third (33%) felt there was no need for a classroom supervisor as they could adequately oversee students themselves.

Among Digital I-TV instructors, 60% felt the supervisor should be present in the classroom at all times, while all Analog instructors (100%) saw no reason for a supervisor to be continually present, indicating that electronic supervision was sufficient. More importantly, two-thirds of all Analog instructors (67%) saw no need for a classroom supervisor at all, while all Digital instructors (100%) did see a need for classroom supervision of some type. Thus further lends support to the inappropriateness of uniform state regulations for supervision of DL courses, given the broad range of technologies and student-teacher audio-visual contact.

TABLE 42: Instructors' Opinions of Qualifications Necessary for Supervisors of Distance Learning Classrooms

	% of DL Instructors in Agreement with Statement
The supervisor should be a certified teacher in the subject matter of the class	8%
The supervisor should be a certified teacher in some subject area	33%
The supervisor should be a certified teacher at the secondary level	17%
The supervisor role can be adequately handled by the superintendent principal, counselor, or other professional employee	75%
The supervisor role can be adequately handled by non-professional staff, e.g., a secretary or a part-time community person hired for the job	75%
The supervisor should have some knowledge of the subject matter being taught	17%
The supervisor should be present in the classroom at all times	33%
Electronic supervision of the students (by TV monitor) is sufficient	58%
There is no need for a classroom supervisor; I can adequately oversee all students	33%

Videotaping of DL Classes

Half of all Interactive TV instructors routinely videotape their classes. Fifty-five percent (55%) videotaped the class for students who cannot view the class live or who are absent from class; 18% videotaped the class for student review purposes; 45% videotaped the class as a way of evaluating their teaching or for their personal library.

DL Instructor Opinion of Synchronized Bell Schedules and School Calendars

All DL instructors believed that participating districts should adopt identical class (bell) schedules, while three-fourths (75%) believed that non-synchronized school calendars present a significant problem to schools participating together in DL courses.

Student Attrition in DL Courses

Seven of the twelve DL instructors (58%) indicated that there were students who had dropped the course during the year. Five of the six Analog I-TV schools (83%) had had students who dropped the course, compared to one of five Digital I-TV schools (20%). It should be kept in mind, however, that the Digital I-TV project had been in operation for only the second semester. Reasons cited by the DL instructors for student attrition is reflected in the table below:

TABLE 43: Reasons For Student Attrition in DL Courses as Indicated by DL Instructors

	% of DL Instructors Giving Reason for Students Dropping DL Course		
	Digital I-TV*	Analog I-TV	Audiogr.Tel.**
Students felt the course was too difficult	0%	17%	100%
Students were not motivated to learn	0%	17%	100%
Students felt too much was expected of them	0%	83%	100%
Conflicts with the instructor or supervisor	0%	0%	0%
Students were uncomfortable with a distance learning format	0%	83%	100%
Students felt they were not learning	0%	0%	100%
Students were frustrated with the technology	0%	0%	100%
Students were concerned about grades, e.g., their GPA or class rank might suffer	0%	0%	100%
Students were frustrated by not having a teacher physically present in the classroom	0%	0%	0%
Students could not quickly get answers to questions	0%	0%	0%
Got too far behind because of illness	20%	--	--
Unusually long absences	--	17%	--
Job release	--	17%	--
Transferred to another school	--	17%	--
Didn't need the course	--	17%	--

* The Digital I-TV classes had been in operation for only one semester at the time of the study.
** The Audiographic Tele-learning responses are based on information provided by one instructor

Of most interest is the five of six Analog I-TV instructors who indicated that some students had dropped the DL course because they felt that too much was expected of them or that they were uncomfortable with the DL format. Also of interest are the 17% of Analog schools who reported non-course related reasons for dropping out, e.g., lengthy absences, job release, school transfer, etc. As the Digital I-TV program was in operation for only one semester, student attrition was not a factor. *None* of the I-TV instructors indicated conflicts with the instructor or supervisor, student frustration with not having a teacher in the classroom, or inability to get questions answered quickly as reasons for student attrition in the DL courses.

Actual numbers of students dropping the DL courses were not in excess of what would be expected within traditional courses.

Instructor Opinion of Amount Learned by DL Students

Instructors were asked to assess the amount learned by their respective DL students during the year. Forty-two percent (42%) indicated their students had learned a great deal; 50% felt their students had learned an acceptable amount; only 1 instructor (8%) indicated that the students had not learned as much as she thought they should have. The breakdown by technology is shown in the table below:

TABLE 44: Instructor Opinion of Amount Learned by DL Students by Technology

	% of DL Instructors Indicating Amount Learned by Students		
	Digital I-TV	Analog I-TV	Audiogr.Tel.
A great deal	20%	50%	50%*
An acceptable amount	60%	50%	50%*
Not as much as I think they should have by now	20%	--	--
Not much at all	--	--	--
	100%	100%	100%

* The Audiographic Tele-learning instructor indicated that the better students learned a great deal while the average students learned an acceptable amount.

Instructor Comparison of DL Classes with Traditional Classes

Instructor attitudes regarding DL classes in comparison with traditional classes seem to indicate universal support for the respective DL technologies employed. All are also in agreement that the DL course is preferrable to no course at all, even though only 25% of the instructors believed that distance learning is the only alternative available for expanding the curriculum.

TABLE 45 : Instructor Comparison of DL Classes With Traditional Classes

	DL Instructor Opinions					
	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	NR
Remote Site DL students generally:						
Learn less than they would in a regular class	--	--	25%	25%	42%	8%
Are frustrated by not having a subject-knowledgeable teacher in the classroom	--	--	25%	17%	50%	8%
Do not want to put forth the effort required	--	--	17%	58%	17%	8%
Distance Learning Courses:						
Give students the opportunity to learn more than they may in a traditional class	8%	8%	25%	--	50%	8%
Is the only viable alternative available for expanding our curriculum	25%	--	33%	8%	25%	8%
Is preferrable to no course at all	67%	25%	--	--	--	8%

When looking at Digital and Analog I-TV instructor attitudes, we see a slightly more positive attitude exhibited among Analog instructors. As compared to only 60% of Digital instructors, all Analog instructors (100%) *disagreed* that DL students learn less, that they are frustrated by not having a subject-knowledgeable teacher in the classroom, and that DL students do not want to put forth the effort required of them.

Instructor Assessment of Who Performs Tasks Associated with Teaching in a DL Classroom

Instructors were given a list of tasks which might be the responsibility of the teacher in a traditional classroom. They were asked who, if anyone, performed those tasks in their distance learning class.

Perhaps of most interest is the role which the instructors see the classroom coordinators playing. They depict a coordinator who basicly oversees tests, who does not identify or solve individual student problems or answer simple questions for students, indeed who, in three-fourths of the schools, does not learn the course material along with the students or even watch all classes with the students. Even maintenance of discipline at the remote sites is seen by half of the instructors as being their own responsibility.

TABLE 46: Instructor Assessment of Who Performs Specific Tasks in a DL Class

	Teacher	Supervisor/ Coordinator	Students	Combi-nation*	No one	Not Applicable/ No Response
Motivates student to do well	83%	8%	--	8%	--	--
Maintains discipline	50%	8%	8%	33%	--	--
Assists students with computer use	17%	17%	--	8%	8%	50%
Assists students with modem or electronic mail	--	17%	--		25%	58%
Encourages students to talk with or call the teacher	33%	33%	--	17%	17%	--
Assists students with software use	25%	8%	--	--	--	67%
Operates the equipment at a remote site	--	17%	50%	33%	--	--
Troubleshoots problems with equipment	8%	25%	8%	58%	--	--
Administers tests	8%	67%	--	25%	--	--
Grades tests	100%	--	--	--	--	--
Constructs quizzes or worksheets to assist student learning	100%	--	--	--	--	--
Identifies and solves problems individual students may be having with the course	75%	--	--	25%	--	--
Learns the course material along with the students	--	25%	--	--	75%	--
Participates or watches all classes along with the students	--	25%	--	--	67%	--
Answers simple questions or helps students find answers to problems	42%	--	--	50%	8%	--

Instructor Opinions of Problems Encountered with the DL Course

Two-thirds (67%) of the DL instructors believed there were aspects of the course or technology on which improvement was needed. No difference existed in this opinion with respect to technology implemented. Three of five Digital I-TV instructors and four of six Analog I-TV instructors, as well as the Audiographic Tele-learning instructor, felt that improvements were needed. Problems listed by instructors along with their severity can be seen in the table below:

TABLE 47: Problems Identified by DL Instructors

Problems Listed by Instructors	Digital I-TV	Analog I-TV	Audiogr.Tel.
Microphones must be passed around for teacher to be able to hear students (Unspecified*)	X		
Students in remote sites cannot converse in language while seeing each other (Unspecified*)	X		
My small screen monitor is hard to distinguish lip sounds or pronunciation (Unspecified*)	X		
There is no control over remote cameras **(Tolerable)**	X		
Student screening needs to be improved--some students who lack responsibility or independence will not do as well, no matter how well they're supervised at the remote site **(Serious)**	X		
Teachers need to have a greater role in planning course offerings and running the system--it shouldn't be just an administrative decision **(Serious)**	X		
Students cannot ask questions if camera is locked in on another school **(Severe)**	X		
A little more advanced communication is needed (Unspecified)		X	
Audio could be cleaner **(Tolerable)**		X	
More microphones are needed **(Tolerable)**		X	
Sound--it is better than tolerable, but always could be improved upon **(Tolerable)**		X	
We need to meet with the whole class early in the school year **(Tolerable)**		X	
Telephone line needs to be improved--data is missed on the computer **(Serious)**			X

* "Unspecified" refers to problems on which instructors did not specify the severity of the problem mentioned.

Judging from the problems and severity specified, the Analog I-TV instructors were most satisfied with how their technology and course operated. Technically, the Analog I-TV instructors found only minor fault with the audio, indicating that the sound could be cleaner and that more microphones were needed.

Of greatest severity was the technical problem mentioned by Digital I-TV instructors concerning the inability for students to converse, ask or respond to questions when the camera is locked on another school. This perceived problem stems from the lack of continuous multi-site audio and

video, as only one site can be seen or heard at one time. Unlike Digital I-TV, Analog I-TV does offer the capability for all sites to be simultaneously seen and heard.

The Audiographic instructor also found serious fault with the quality of phone lines resulting in poor data and voice transmission between computer sites.

Instructor Opinion of the Future of Their DL Technology

All North Dakota Distance Learning instructors felt that the widespread use of their particular technology would grow whether or not the remaining problems with the technology are resolved. None felt that other DL technologies would likely take its place and only one instructor felt that there will cease to be a need for distance learning.

Written comments offered by the instructors show substantial support for their involvement in the DL program. Excerpts are included below:

> "For the most part, my I-TV experience has been challenging and rewarding. I look forward to teaching on the system again." (Analog)
>
> "I feel I-TV is an excellent alternative to small rural schools. Used to its full potential, classes never feasable will now be easily accessable to the rural high school student." (Digital)
>
> "I have loved teaching on I-TV and I would teach more I-TV classes. The learning success is the same as the traditional classroom--the techniques are easier... We had more problems with coordinating schedules and administrative policies among schools than really technical problems." (Analog)
>
> "I am anxious to continue I-TV teaching and I am very satisfied with the technology itself. I am confident that it is an effective teaching tool. I am concerned, however, that in some cases it may be viewed as an approach to basic curriculum on many levels. If we are truly concerned with quality and enhanced learning, we need to realize that it is not for every student, nor is it for every teacher." (Digital)

SIGNIFICANT CROSS-TECHNOLOGY COMPARISONS

Amount of Student-Teacher Interaction

Student-teacher interaction was significantly greater in Audiographic and Interactive TV classes with 100% and 91% of the students respectively reporting some interaction, as compared to 62% of Instruction by Satellite students. Frequency of interaction was highest in Audiographic classes with 86% of the students reporting interaction more often than three times per week, compared to 58% of I-TV students and 1% of Instruction by Satellite students.

TABLE 48: Frequency of Student-Teacher Interaction During Class Time by Technology

	% of Students							
	Never	Rarely	Once/ Month	2-3 Times Month	Once/ Week	2-3 Times Week	More Often	Total
Interactive TV	**9%**	**8%**	**1%**	**2%**	**6%**	**16%**	**58%**	**100%**
Analog	10%	8%	2%	2%	6%	20%	53%	100%
Digital	6%	8%	--	4%	4%	8%	69%	100%
Instruction by Satellite	**38%**	**20%**	**14%**	**11%**	**4%**	**13%**	**1%**	**100%**
TI-IN	--	12%	12%	38%	38%	--	--	100%
OSU	85%	12%	--	--	--	--	3%	100%
SERC	5%	28%	26%	16%	--	26%	--	100%
Audiographic Tele-learning	--	--	--	--	**7%**	**7%**	**86%**	**100%**

Within techologies, frequency of interaction is slightly higher in Digital I-TV classrooms as compared to Analog classrooms, although spontaneity of interaction is clearly facilitated to a greater extent with the Analog techology and it is suspected, although not directly addressed in the study, that more interactions occur per class period with that technology.

Comparison of DL with Traditional Courses

The comparison of distance learning with traditional courses was the focus of several questions answered by both classroom coordinators and remote Audiographic and I-TV instructors. Respondents were asked

whether they agreed or disagreed with a series of six statements concerning DL students and courses.

TABLE 49: Coordinator and Instructor Comparison of Distance Learning with Traditional Students: Amount Learned & Student Frustration

Statement	% Of Coordinators (Instructors) Agree or Strongly Agree	Undecided	Disagree or Strongly Disagree
Remote site DL students learn less			
Interactive TV	**11%**	**11%**	**78%**
Analog	--	--	100% (100%)
Digital	20%	20% (40%)	60% (60%)
Instruction by Satellite	**50%**	**20%**	**30%**
TI-IN	50%	--	50%
OSU	67%	--	33%
SERC	40%	40%	20%
Audiographic Tele-learning	--	**33% (100%)**	**67%**
Remote site DL students are frustrated by not having a subject knowledgeable teacher in the classroom			
Interactive TV	**13%**	**13%**	**75%**
Analog	--	--	100% (100%)
Digital	25%	25% (20%)	50% (60%)
Instruction by Satellite	**40%**	**20%**	**40%**
TI-IN	50%	--	50%
OSU	33%	33%	33%
SERC	40%	20%	40%
Audiographic Tele-learning	**67%**	--	**33% (100%)**

Instruction by Satellite coordinators were much more likely to believe that remote site DL students generally learn less than they would in a regular class. Audiographic coordinators were more likely to believe that DL students are frustrated by not having a subject-knowledgeable teacher in the classroom and that DL students do not want to put forth the effort required of them.

The majority of both I-TV and Instruction by Satellite coordinators believed that DL courses give students the opportunity to learn more than they may in a traditional class.

OSU Instruction by Satellite coordinators were unique in questionning whether DL courses are the only viable alternative for expanding the curriculum or whether they are preferrable to no courses at all.

TABLE 50: Coordinator and Instructor Comparison of Distance Learning with Traditional Students: Student Effort Required

Statement	% Of Coordinators (Instructors) Agree or Strongly Agree	Undecided	Disagree or Strongly Disagree
Remote site DL students do not want to put forth the effort required			
Interactive TV	**22%**	**11%**	**67%**
Analog	--	--	100% (100%)
Digital	40%	20% (40%)	40% (60%)
Instruction by Satellite	**40%**	**10%**	**50%**
TI-IN	--	50%	50%
OSU	33%	--	67%
SERC	60%	--	40%
Audiographic Tele-learning	**67%**	--	**33% (100%)**

TABLE 51: Coordinator and Instructor Comparison of Distance Learning with Traditional Courses: Learning Opportunity

Statement: Distance learning courses give students the opportunity to learn more. . .	% of Coordinators (Instructors) Agree or Strongly Agree	Undecided	Disagree or Strongly Disagree
Interactive TV	**63%**	**37%**	--
Analog	50% (20%)	50%	--
Digital	75% (20%)	25% (40%)	-- (40%)
Instruction by Satellite	**50%**	**40%**	**10%**
TI-IN	50%	50%	--
OSU	67%	--	33%
SERC	40%	60%	--
Audiographic Tele-learning	**33%**	**-- (100%)**	**67%**

TABLE 52: Coordinator and Instructor Comparison of Distance Learning with Traditional Courses: Only Viable Alternative

Statement: Distance learning courses are the only viable alternative for curriculum expansion	% Of Coordinators (Instructors) Agree or Strongly Agree	Undecided	Disagree or Strongly Disagree
Interactive TV	**63%**	**25%**	**12%**
Analog	50% (60%)	50%	-- (40%)
Digital	75% (60%)	--	25% (40%)
Instruction by Satellite	**70%**	**--**	**30%**
TI-IN	100%	--	--
OSU	33%	--	67%
SERC	80%	--	20%
Audiographic Tele-learning	**100%**	**--(100%)**	--

TABLE 53: Coordinator and Instructor Comparison of Distance Learning with Traditional Courses: Preferable to No Course

Statement: Distance learning courses are preferrable to no course at all	% Of Coordinators (Instructors) Agree or Strongly Agree	Undecided	Disagree or Strongly Disagree
Interactive TV	**100%**	--	--
Analog	100% (100%)	--	--
Digital	100% (100%)	--	--
Instruction by Satellite	**70%**	**10%**	**20%**
TI-IN	100%	--	--
OSU	33%	33%	33%
SERC	80%	--	20%
Audiographic Tele-learning	**100% (100%)**	--	--

Costs of Distance Learning

In North Dakota, as elsewhere, distance learning costs vary tremendously not only by technology but within each technology. While Instruction by Satellite had the lowest average implementation cost of the three major technology types at just under $20,000 per school, three factors bear mentioning: (1) Depending upon the source of Instruction by Satellite, average costs ranged from $13,000 to $32,000; (2) incomplete implementation of OSU's Instruction by Satellite classes by some schools may have affected the lower dollar implementation costs; and (3) the average SERC cost of $20,558 in North Dakota did *not* include the $35,000 state membership fee, making that particular program much more expensive than it appears.

The Analog Interactive TV technology was the most expensive to implement, by far, but the costs of equipment and fiber optic line purchase or lease was highly variable, depending both upon a given school's existing access to fiber optic capabilities and the pricing policies of the telephone company with whom the school must deal. The average cost of Digital Interactive TV systems in North Dakota was approximately half that of the Analog systems, but the capability for

spontaneous student-teacher interaction also differed, again raising the issue of the value of student-teacher interaction.

The Audiographic Tele-learning projects averaged just over $23,000 in terms of implementation costs, making the technology more expensive than Instruction by Satellite though less than Interactive TV. The annual costs of continuing Audiographic classes, however, was far less than that of the other two technologies, but the purposes for which it is used may be more restricted. Teacher in-service training, for instance, would be very difficult to carry out via this technology.

Issues of cost are extremely difficult to compare with respect to distance learning, not only as they relate to student performance but also because of the variability with which they are implemented across adopting school districts. Incomplete or inadequate implementation, e.g., excluding one or more intended course components, is a particular problem in trying to equate Instruction by Satellite costs with those of other technologies. Some technology costs involve incremental increases with each course offered; others bear a standard fee with access to any or all courses offered. Some costs include auxiliary services, e.g., teacher in-service programming, at a set fee; some include a portion of the programming at no extra charge, while charging additionally for other programs viewed; others charge separately for each program viewed.

In summary, it appears that there is no simple nor conclusive answer to the question: Which technology provides the best education at the lowest cost? It is equally clear that adopters must look at the costs incurred with each technology as they apply to their own situation. Given the technological naivete of most school administrators, it is imperative that they enter into the distance learning arena prepared to evaluate each technology according to their own identified needs, financial contraints, and existing capabilities. It is equally imperative that they realize there is no "package deal"--one cannot "purchase" Instruction by Satellite or Interactive TV or Audiographic Tele-learning as one would buy a new textbook. There are multiple components and variable equipment pieces connected not only with each technology, but with each provider of distance learning courseware. Third-party vendors differ considerably with respect to the costs of similar equipment and equalivalent quality cannot always be readily verified.

Distance learning adopters are clearly in need of a source of technological expertise and implementation assistance apart from the commercial DL providers or equipment vendors. This should be a major focus of state education agencies as we prepare for the 21st century.

TABLE 54

DISTANCE LEARNING COSTS IN NORTH DAKOTA

1990 North Dakota Distance Learning Study

Technology (# of Schools on Which Cost Data is based)	Implementing Costs: Average Cost per School	Est. Annual Costs: Average Cost per School
Instruction by Satellite (10)	$19,994	$11,675
OSU (4)	$13,183	$ 6,463
SERC (4)	$20,558*	$15,580*
TI-IN (2)	$32,490	$16,240
Audiographic Tele-learning (4)	$23,177	$ 7,676
Digital Interactive TV (5)	$29,502	$ 17,625
Analog Interactive TV (4)	$60,706	$ 12,711
Total Costs (23)	$682,984	$257,118**
Average across all technologies:	$29,695*	$ 12,244*
Total Estimated Cost of having implemented DL in the current 28 adopter districts	$786,258*	$386,240*

* does not include the $35,000 state fee assessed

**based on 21 schools providing data

An Assessment of Traditional vs. DL Student Achievement

Because the North Dakota DL courses in Spanish and German both enrolled the largest number of students and were taught utilizing different technologies, it was believed that those courses would be the most logical for assessing DL student achievement through a standardized test.

In searching for such a measure to assess student achievement, two instruments were located. The "National Spanish Examination" and the "American Association of Teachers of German (AATG) Level I test, Form B".

In studying the following tables, several precautionary statements should be taken into account:

(1) While the National Spanish Examination does report a national average (mean) for those high school students taking each test level, the AATG German test does not collect student test data at that level. The only basis for comparison of German test scores is with a University of Colorado-Boulder pretest of Level 1 Test, Form B.

(2) The AATG German test is designed for secondary school students, to be taken at the end of their first year of German instruction. The pretest, however, with University of Colorado students was administered on the premise that a first-level secondary school course roughly corresponds to a first-semester college course. Exception could certainly be taken to this assumption.

(3) Any comparison of Digital I-TV Spanish scores with other technologies should take into account that the Digital courses were in operation for only one semester, while all other courses were two-semesters in length.

As can be seen in the following table, Analog I-TV and OSU Instruction by Satellite percent scores on the German test differed by only 1 percentage point. Neither, however, favorably compare with the University pretest average of 81%. Possible interpretations of this seemingly large gap, however, are several:

(1) There may be a significant difference in student achievement attributable to method of instruction, i.e., traditionally taught students may indeed learn more than distance learning students.

(2) It could be purported that, as mentioned above, a comparison of a 1st semester college course with an introductory high school course is not a fair comparison of amount or focus of material covered.

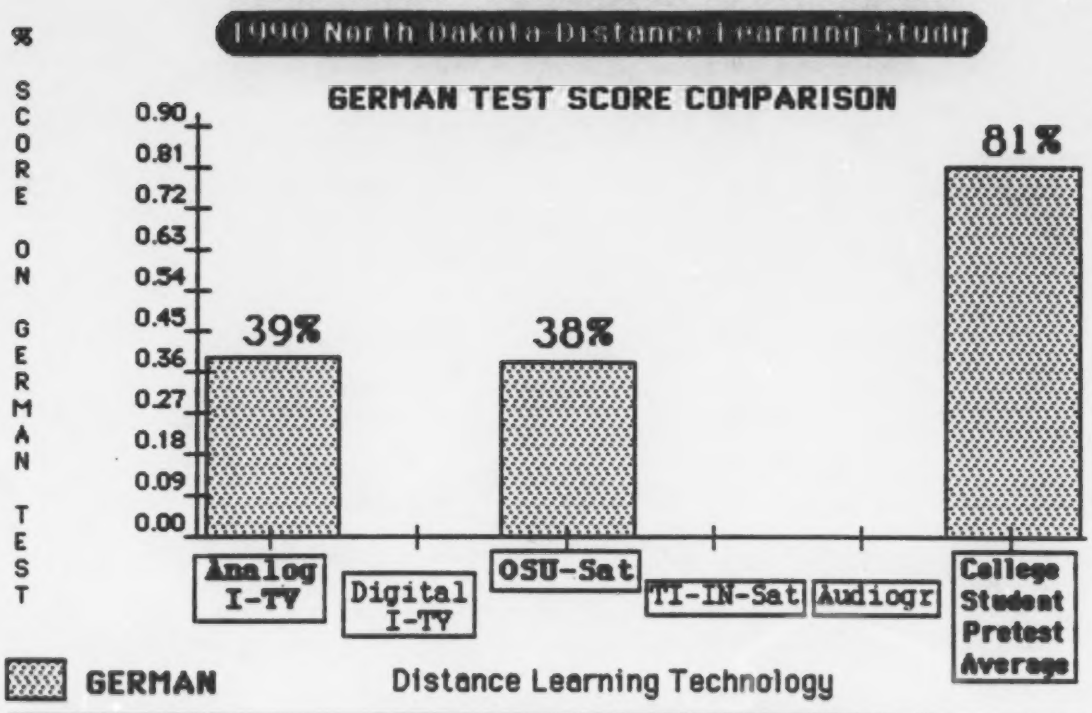
(3) Finally, it could be suggested that a national standardized test, in order to accurately measure achievement assumes that a national curriculum is in place. In the case of the Analog I-TV and OSU German courses, both utilize non-traditional curriculums, designed specifically for their individual courses and do not rely, to any real extent, on what might be considered a traditional curriculum. It is therefore, highly questionnable whether such a national test can indicate anything other than the extent to which student achievement conforms to the curricular focus on which the test was based. For example, the OSU course is heavily culturally oriented, while the AATG test would not reflect any student knowledge of German culture.

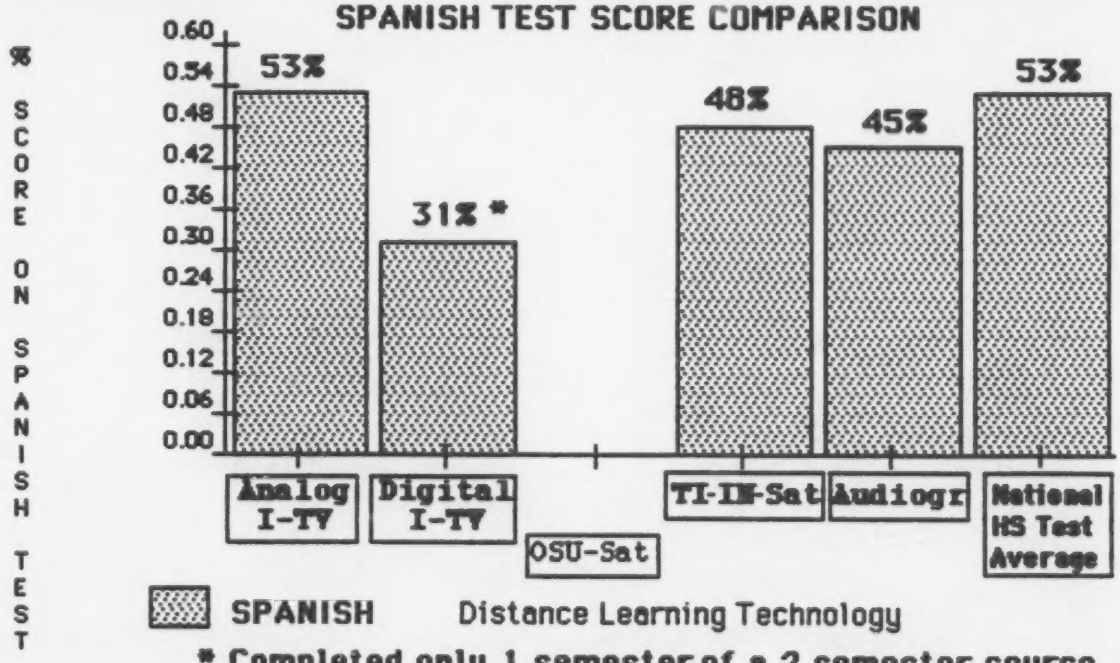
Comparison of student test scores on the National Spanish Examination reveal scores strikingly similar to the national average. Discounting the Digital I-TV students, who had completed only a one-semester course, the range of the average Analog I-TV, TI-IN by Satellite and Audiographic scores was only eight percentage points. Of particular note is the identical average score of Analog I-TV Spanish students with the national average for the 1990 test.

It is therefore concluded that, on the basis of this data, there does not appear to be any discernible difference between distance learning and traditional foreign language student achievement attributable to the specific distance learning technologies utilized.

TABLE 55
ACHIEVEMENT TEST SCORES BY TECHNOLOGY

1990 North Dakota Distance Learning Study





* Completed only 1 semester of a 2 semester course

DISTANCE LEARNING STUDENT PROFILE BY TECHOLOGY

If indeed, as pointed out above, the technology per se does not appear to significantly affect student achievement, how might the characteristics individual students bring with them to the DL course interact with the technology implemented? We will begin with a description of DL student characteristics and, in the following section, attempt to relate those characteristics and others to performance on the standardized tests in German and Spanish.

Grade Level

Although nearly one-half of all DL students (48%) were high school seniors and one fourth (25%) were juniors, differences among technologies were obvious. While underclasspersons comprised 28% of Interactive TV and 30% of Instruction by Satellite students, only 7% of Audiographic students were freshmen or sophomores. Conversely, upperclasspersons (juniors or seniors) comprised 72% of I-TV students, 70% of Instruction by Satellite students, and 92% of Audiographic students.

Class Rank

Two thirds of all DL students were in the top half of their graduating class. By technology, however, 60% of I-TV students ranked in the top half as compared to 80% of Instruction by Satellite and 90% of Audiographic students.

Graduating Class Size

The graduating class size of DL students ranged from 5-314. (Keep in mind that some students were enrolled in larger schools from which DL teaching and courses originated.) Average graduating class size was nearly identical for Audiographic and I-TV students at 32 and 33, respectively. Instruction by Satellite students' graduating class size averaged 91, however, ranging from 13 for TI-IN students to 147 for SERC students.

Grade Point Average

Thirty-nine percent (39%) of DL students had GPA's of 3.5 or above on a 4.0 scale, with an equal percentage (39%) having GPA's of 2.0 or below. By technology, however, both Instruction by Satellite and Audiographic students were more likely to have higher GPA's than their I-TV counterparts.

Motivation Level

On a scale of 1-5, DL students were assessed by their administrators as to their level of motivation. Overall, 64% of the students were considered highly or somewhat motivated, i.e., ranking of 1 or 2. Only 12% were considered highly or somewhat unmotivated, i.e., ranking of 4 or 5). Level of motivation did not vary significantly, by technology, except for the 22% of Instruction by Satellite students who were thought to be highly or somewhat unmotivated. This can be explained, presumably, by the students' frustration with the incomplete implementation of the technology and lack of coordinator support as evidenced by survey findings.

If one were to attempt to predict student achievement, based solely on the student characteristics cited above, one might expect Audiographic students to have the edge because of the greater enrollment of upperclass students, the higher percentage of students ranked in the top half of their class, and a greater percentage of students with high GPA's.

Instruction by Satellite students appear to have the advantage of coming from larger schools and--at least by conventional wisdom standards--might have broader curricular backgrounds. They also have higher GPA's and higher class ranks than their I-TV counterparts, but lower motivation levels.

Interactive TV students might be predicted to do less well, because of lower GPA's and a smaller percentage of students ranked in the top half of their class.

The following table shows the relative advantages and disadvantages to hypothesized student achievement with each technology.

TABLE 56: Relative Student Characteristic Advantages and Disadvantages to Hypothesized Student Achievement by Technology

Student Characteristics	Interactive TV	Instruction by Satellite	Audiographic Tele-learning
Grade Level	--	--	Advantage
Class Rank	Disadvantage	Advantage	Advantage
Graduating Class Size	--	Advantage	--
GPA	Disadvantage	Advantage	Advantage
Motivation Level	--	Disadvantage	--

RELATIONSHIP OF STUDENT CHARACTERISTICS TO ACHIEVEMENT TEST SCORES

Class Rank

There appears to be a significant relationship between students' class rank and their individual scores on the national standardized tests in Spanish and German. Eighty-six percent (86%) of the students ranking in the top 5% of their graduating class scored above the state mean on the tests, while 0% of those graduating in the bottom 10% of the class did so.

Of course, one would logically assume that student rank in their graduating class would be associated with how well they would do in any course, whether or not it was via distance learning.

TABLE 57: DL Student Class Rank by Student Achievement Test Scores in German & Spanish

	% of DL Students by Class Rank							
	Top 5%	Top 6-10%	Top 11-20%	Top 21-30%	Top 31-50%	Top 51-75%	Top 76-89%	Lower 10%
Above State Mean	86%	78%	56%	60%	55%	32%	33%	0%
Below State Mean	14%	22%	44%	40%	45%	68%	67%	100%
	100%	100%	100%	100%	100%	100%	100%	100%

Cumulative GPA

Student cumulative grade point averages appear *not* to be significantly associated with DL student test scores in German and Spanish *except* where student GPA's fall below 2.00 on a 4-point scale. It should be remembered, however, that ability alone does not necessarily explain high or low GPA. Other factors such as student motivation may have an equally or more important part.

TABLE 58: Student GPA's by Achievement Test Scores in German & Spanish

	% of DL Students by Grade Point Average							
	3.75-4.00	3.50-3.74	3.00-3.49	2.50-2.99	2.00-2.49	1.50-1.99	1.00-1.49	0.00-0.99
Above State Mean	46%	71%	41%	41%	44%	0%	0%	--
Below State Mean	54%	29%	59%	59%	56%	100%	100%	--
	100%	100%	100%	100%	100%	100%	100%	--

Student Motivation Level

Administrators' assessment of student motivation level proved to be less than a perfect predictor of student success as well. Fifty-six percent (56%) of those considered to be somewhat or highly motivated scored above the state mean on the German or Spanish Achievement Test, while 18% of those considered to somewhat or highly unmotivated did so. It is interesting, however, that there is a direct relationship between level of motivation and percent of students scoring above the state mean, that is, the greater the level of motivation (as assessed by administrators), the higher the probability of scoring above average on the test. At either extreme of the motivation continuum we see that nearly three-fourths (73%) of those students considered as highly motivated scored above the state mean while all students (100%) considered to be highly unmotivated scored below the state mean.

TABLE 59: Student Motivation Level by Achievement Test Scores in German & Spanish

	% of DL Students by Motivation Level Assessed by Administrators				
	Highly Motivated	Somewhat Motivated	Marginally Motivated	Somewhat Unmotivated	Highly Unmotivated
Above State Mean	73%	47%	42%	29%	0%
Below State Mean	27%	53%	58%	71%	100%
	100%	100%	100%	100%	100%

Grade Level of Enrolled Students

DL students taking the German and Spanish tests were evenly distributed among all four high school grade levels. Very little difference existed among students by grade level with the exception of Seniors who scored significantly lower than other students and sophomores who scored somewhat higher than other students. No inherent reason appears to exist for differential achievement by grade level apart from other student and course characteristics.

TABLE 60: Student Grade Level by Achievement Test Scores in German & Spanish

	% of DL Students by Grade Level			
	9th Grade	10th Grade	11th Grade	12th Grade
Above State Mean	53%	65%	54%	32%
Below State Mean	47%	35%	46%	68%
	100%	100%	100%	100%

Student Characteristics Considered Important by Students

When asked to indicate which of the following characteristics they thought were most helpful in the distance learning course, students most often indicated "taking responsibility for their own learning" and "a willingness to work on their own". Eighty-eight percent (88%) of the students scoring above the state mean thought a willingness to work on their own was most helpful while 77% of those who scored below the state mean believed likewise. Similarly, 88% of those scoring above the mean thought that the ability to take responsibility for their own learning was helpful in the course, while 83% of those scoring below the mean felt so.

No real difference between perceptions of those scoring above or below the state mean existed with the exception of intelligence level. Sixty-one percent (61%) of those scoring above the mean felt that an above average intelligence level was helpful in the DL course, while only 37% of those scoring below the mean believed likewise.

TABLE 61: Characteristics Thought by Students to be Most Helpful in a Distance Learning Course by Achievement Test Scores in German & Spanish

	% of Students Above State Mean	% of Students Below State Mean
Taking responsibility for their own learning	88%	83%
Willingness to work on their own	88%	77%
A high level of motivation	79%	76%
An outgoing personality	61%	65%
An interest in or aptitude for use of technical equipment	53%	44%
An above average intelligence level	61%	37%

Notably absent from the current research study is any data relating student learning style to achievement in DL courses. While collection of such data was beyond the scope of the current study, it could certainly be hypothesized that differential learning styles may account to some extent for differential success levels among students. Differences in learning styles, however, can account for differential success in the traditional classroom as well, when those differences are not taken into account.

In summary then, we find that class rank, student motivation level, and--in the absence of explicit learning style data--a desire to take responsibility for their own learning and a willingness to work on their own are the characteristics most highly associated with above average achievement test scores.

RELATIONSHIP OF COURSE CHARACTERISTICS TO ACHIEVEMENT TEST SCORES

In addition to the use of educational technology in instruction and the characteristics of individual students in the courses, one additional factor must be viewed as a potential variable in student achievement--the characteristics of the DL courses themselves, including implementation practices.

Implementation of OSU German by Satellite Course Components

OSU German by Satellite is unique in its multi-directional approach to instruction. Apart from the two day per week broadcasts via satellite, the German course is intended to involve students in three separate computerized drill and practice software programs and a computerized Voice-Based Learning System. Use of audiotapes both with the Worschatz software and with the lab/workbook are also included as intended course components. The extent to which all components are indeed implemented (and utilized) appears to be critical to student achievement.

TABLE 62: Effect of Implementation/Student Utilization of Non-Broadcast Course Components in OSU German by Satellite on Student Standardized Test Scores

	Student Use of **Dasher** Software (grammar)			
	Never	Rarely	Once/mo or more	Total
Above State Mean	0%	0%	100%	100%
Below State Mean	7%	36%	57%	100%
	Student Use of Worschatz Software (vocabulary)			
	Never	Rarely	Once/mo or more	Total
Above State Mean	0%	0%	100%	100%
Below State Mean	50%	14%	36%	100%
	Student Use of Diktat Software (dictation)			
	Never	Rarely	Once/mo or more	Total
Above State Mean	0%	50%	50%	100%
Below State Mean	57%	7%	36%	100%

TABLE 62 (CONT.): Effect of Implementation/Student Utilization of Non-Broadcast Course Components in OSU German by Satellite on Student Standardized Test Scores

	Never	Rarely	Once/mo or more	Total
Student Use of Voice-Based Learning System				
Above State Mean	20%	40%	40%	100%
Below State Mean	62%	23%	15%	100%
Student Use of Audiotapes w/Worschatz software				
Above State Mean	50%	10%	40%	100%
Below State Mean	62%	15%	23%	100%
Student Use of Audiotapes Provided w/Lab Book				
Above State Mean	0%	9%	91%	100%
Below State Mean	38%	31%	31%	100%

All OSU German by Satellite students scoring above the state mean on the national test utilized both Dasher and Worschatz once per month or more as compared to 57% and 36%, respectively, of those students scoring below the state mean. Both Diktat and VBLS usage among students scoring above the state mean was markedly higher than for those scoring below the mean, as was use of audiotapes both with the Worschatz software and with the lab/workbook.

In terms of other OSU German by Satellite course components--accessing the professor via electronic mail, calling in to the professor during broadcasts, or calling in either at other times of the day or from home at night--individual contact with the professor was virtually nonexistent among all students.

TABLE 63: Effect of Instructor Access Components in OSU German by Satellite on Student Standardized Test Scores

	Never	Rarely	Once/mo or more	Total
Student Use of Electronic Mail				
Above State Mean	90%	10%	0%	100%
Below State Mean	92%	8%	0%	100%
Student Call-Ins During Broadcasts				
Above State Mean	100%	0%	0%	100%
Below State Mean	100%	0%	0%	100%
Student Call-Ins During Other Times of Day				
Above State Mean	90%	10%	0%	100%
Below State Mean	69%	23%	8%	100%
Student Call-Ins From Home at Night				
Above State Mean	90%	10%	0%	100%
Below State Mean	100%	0%	0%	100%

Student Perception of Whether Improvements are Needed in the Course

Little difference existed between the perceptions of those students who scored above or below the state mean on the German and Spanish Achievement Tests with respect to whether they felt there were aspects of the course which needed to be improved upon or changed. Fifty-four percent (54%) of those scoring above the mean felt improvements were needed; 48% of those scoring below the mean felt changes were in order.

Importantly, this would seem to indicate that student achievement was not affected by technical or other course problems perceived by students.

TABLE 64: Student Perception of Whether Course Improvements are Needed by Achievement Test Scores in German & Spanish

	% Believing Improvements are Needed	% Believing Improvements are NOT Needed
Above State Mean	54%	46%
Below State Mean	48%	52%

Performance of Classroom Tasks in a Distance Learning Classroom

One of the major factors in which distance learning classes differ from traditional classrooms is the extent to which students are directly responsible for what are normally considered "teacher duties". Students were given a series of tasks which might normally be the responsibility of the teacher in a traditional class and were asked to identify who, if anyone, performs the task in their distance learning class. The following table relates the performance of those tasks to student achievement test scores.

Perhaps of greatest importance in the study is the apparent effect of teacher task performance on student achievement test scores in German and Spanish. The following table shows that where someone--either the remote teacher, the classroom coordinator, or other students--perform each of the tasks listed below, there is a clear association with improvement in achievement test scores. Where *someone* identifies and solves individual DL student problems, achievement test scores rise an average of 38%. Of somewhat less, but still significant, impact is the effect of performance of the other teacher tasks on student achievement. *Who* performs the task is not as important as *whether* the task is performed.

Because of the relatively small numbers involved, it is not possible to determine within the scope of this study the *cumulative* effect of performance of each task on student test scores, however it is hypothesized that a cumulative effect is present, i.e., that those students for whom more tasks are performed will score higher on achievement tests than those students for whom fewer tasks are performed.

Different technologies may require different application of this finding, that is, while instruction by Satellite classes may necessitate a full-time classroom coordinator in order to insure performance of these tasks, interactive TV students may rely on the remote teacher for the

majority. As one can quickly see, a state regulation requiring that a certified teacher be in the local classroom does not insure that any of the tasks will be carried out. It is therefore instructive to state policy makers that more attention and emphasis need be put on the tasks associated with student success than on the regulation of a classroom supervisor who may or may not perform the necessary support role.

TABLE 65: The Effect of Performance of Selected "Teacher Tasks" in DL class on Achievement Test Scores in German & Spanish

	Average Percentage Increase in Student Achievement Test Scores with Performance of Task by Either the Remote Teacher, the Classroom Coordinator, or other Students
Identifies and solves problems individual students may be having with the course	38%
Maintains discipline	28%
Answers simple questions or helps students find answers to problems	24%
Learns the course material along with the students	23%
Troubleshoots problems with equipment	22%
Constructs quizzes or worksheets to assist student learning	21%
Participates or watches all classes along with the students	16%
Motivates student to do well	11%

MEASURES OF STUDENT SUCCESS IN DISTANCE LEARNING COURSES

While the study has consistently used standardized test scores as the basis for comparing student achievement given different input variables, there are several other "measures of student success" which when taken as a whole, in addition to test scores, may give a more valid interpretation of which method(s) of distance learning appear(s) to be more conducive to student success.

Perception of "Amount Learned" in DL Courses

One factor which serves as a subjective measure of student success is the students' perception of the "amount they have learned". This was operationalized by asking students to indicate whether they had learned "a great deal", "an acceptable amount", "not as much as I think I should have", or "not much at all". Among the three major types of DL technology, students believed they learned most in Interactive TV classrooms--83% of the students indicated having learned "a great deal" or "an acceptable amount". Audiographic tele-learning ranked second with 64% of the students having learned "a great deal" or "an acceptable amount". Instruction by Satellite ranked last with 54% similarly rating their knowledge.

If we look at the other end of the continuum, we find that while 15% of the Instruction by Satellite students believe they learned "not much at all", 0% of the Audiographic students felt likewise.

TABLE 66: Amount Learned In Students' Perception

	A GREAT DEAL	AN ACCEPTABLE AMOUNT	NOT AS MUCH AS I THINK I SHOULD HAVE	NOT MUCH AT ALL
INTERACTIVE TV	**34%**	**49%**	**11%**	**6%**
DIGITAL I-TV	31%	41%	18%	10%
ANALOG I-TV	35%	53%	8%	4%
INSTRUCTION BY SAT	**15%**	**39%**	**31%**	**15%**
TI-IN*	38%	50%	12%	0%
OSU	12%	36%	39%	12%
SERC	13%	38%	28%	21%
AUDIOGRAPHIC TELE-LEARNING	**28%**	**36%**	**36%**	**0%**

* Based on only 2 TI-IN sites operating in state

In comparing student, coordinator, and instructor perceptions of "amount learned" by DL students in North Dakota, we see strikingly similar results. With the exception of Audiographic Tele-learning, rankings appear to coincide. In terms of perceived amount learned by students, I-TV ranked first, Audiographic Tele-learning ranked second, and Instruction by Satellite ranked third. Within the technologies, Analog I-TV appears to slightly outrank Digital I-TV; and SERC and OSU fall behind TI-IN in terms of perceived amount learned.

TABLE 67: STUDENT, INSTRUCTOR, AND COORDINATOR PERCEPTION OF AMOUNT LEARNED BY DL STUDENTS

	Ranking by Technology*			
	Student Rank	Instructor Rank	Coordinator Rank	Average Ranking
Digital I-TV	3	3	1	(3) 2.33
Analog I-TV	2	1	3	(2) 2.00
TI-IN by Satellite	1	NA**	2	(1) 1.5***
OSU by Satellite	6	NA**	6	(6) 6.00
SERC by Satellite	5	NA**	5	(5) 5.00
Audiographic Tele-learning	4	1	4	(4) 3.00

* based on % assessing students as "having learned a great deal"

** instructors not located in North Dakota were not surveyed

*** based on only 2 TI-IN sties with a total of 8 student responses.

Second Semester Grades Received by DL Students

Grades received by DL students for their second semester distance learning courses also reflect a higher percentage of "A"'s among Interactive TV students than among students in other technologies. Little difference existed, however, among I-TV and Instruction by Satellite students when looking at the number of "A" and "B" students combined. Eighty-three percent (83%) of I-TV and 80% of Instruction by Satellite students received semester grades of "A" or "B", compared with 58% of Audiographic students.

It should be pointed out, however, that no common grading standards existed across the three technologies nor across the schools involved.

TABLE 68: Second Semester Grades for DL Students by Technology

	% of Students					
	A	B	C	D	F	Total
Interactive TV	**54%**	**29%**	**13%**	**3%**	**1%**	**100%**
Digital	46%	19%	24%	5%	5%	100%
Analog	57%	32%	10%	2%	0%	100%
Instruction by Satellite	**44%**	**36%**	**6%**	**10%**	**4%**	**100%**
TI-IN*	63%	25%	--	13%	--	100%
OSU	23%	31%	8%	31%	8%	100%
SERC	48%	41%	7%	--	3%	100%
Audiographic Tele-learning	**29%**	**29%**	**21%**	**7%**	**14%***	**100%**

*based on 2 of 14 students

Student Desire to Enroll in Another Distance Learning Course

Another measure of "student success" is the extent to which students indicate they would enroll in another distance learning course. Ninety-three percent (93%) of I-TV students said they would enroll in another DL course compared to 71% of Audiographic and 51% of Instruction by Satellite students.

Again, when looking at the different systems within each technology, Digital I-TV ranks slightly ahead of Analog I-TV, while OSU Instruction by Satellite falls behind SERC in terms of student willingness to enroll in another DL course. TI-IN heads the Instruction by Satellite systems in terms of student satisfaction, but the small number of TI-IN students enrolled in North Dakota prevents the association of a high level of confidence with these findings.

TABLE 69: Would Students Enroll in Another Distance Learning Course?

	YES	NO	NOT SURE
Interactive TV	**93%**	**6%**	**1%**
Digital	96%	4%	--
Analog	92%	6%	1%
Instruction by Satellite	**51%**	**49%**	--
TI-IN	75%*	25%*	--
OSU	41%	59%	--
SERC	54%	46%	--
Audiographic Tele-learning	**71%**	**29%**	--

* based on only 8 students

Student Perception of Whether DL Course Improvements are Needed

Students exhibited differential perceptions of whether there were improvements needed in their DL course by the technology utilized. TI-IN by Satellite students found least fault with their DL courses with only one of the eight students (13%) indicating that course improvements were needed as compared with 31% of Analog I-TV students, 63% of Digital I-TV students, 66% of OSU by Satellite students, 68% of SERC by Satellite students, and 100% of Audiographic Tele-learning students.

TABLE 70: Student Perception of Whether Improvements are Needed in the Distance Learning Course

	% of Students	
	YES	NO
Interactive TV	**40%**	**60%**
Digital	63%	27%
Analog	31%	69%
Instruction by Satellite	**62%**	**38%**
TI-IN	13%	87%
OSU	66%	34%
SERC	68%	32%
Audiographic Tele-learning	**100%**	**0%**

Student Achievement Test Scores

As discussed previously, student scores on the national standardized tests in German and Spanish indicated little difference among the three technologies with respect to student test performance. Audiographic tele-learning students scored 5 points above Instruction by Satellite students overall, with I-TV students scoring two points above Instruction by Satellite students.

TABLE 72: Combined DL Student Results on National Examinations in Spanish and German

	Raw Score**	# of Students for Whom Test Results are Available
INTERACTIVE TV	**33**	**71**
DIGITAL	25*	14
ANALOG	35	57
INSTRUCTION BY SATELLITE	**31**	**27**
OSU	31	25
TI-IN	39	2
SERC	(No students)	
AUDIOGRAPHIC TELE-LEARNING	**36**	**27**

* Students in these schools had only 1 semester of a 2 semester course.

** Raw scores have been adjusted for differential numbers of questions on Spanish and German tests. Adjusted scores have been rounded to the nearest whole number.

When breaking test results down by specific language, no difference appears between Interactive TV and Instruction by Satellite students with respect to German test scores.

Analog I-TV students in Spanish scored slightly higher than TI-IN by Satellite students who scored slightly higher than Audiographic students, the differential being a total of only 5 points.

Direct comparison of Analog with Digital I-TV student test scores is not possible, as the Digital courses were in operation for only one semester, while the Analog students had completed a two-semester course.

Beyond the previous disclaimers, it is possible to conclude, although somewhat tenuously, that:

(1) national achievement tests are probably a better measure of <u>what</u> is taught in a course rather than how well it is taught;

(2) The slight difference in student scores among technologies infers little, if any, difference in how well students learn with each technology.

(3) Apparently more important than the technology used is the curriculum offered, the teacher's ability to convey knowledge or induce learning, and the students' "study/work ethic". This position is strongly supported by the Audiographic Tele-learning course in Spanish, whose instructor obviously compensated most well for some rather serious technological disadvantages. Inability to clearly hear or communicate with the instructor at

all times seemingly had no effect on student test scores, i.e., the instructor was able to insure learning in spite of, rather than because of, the technology. (It should be pointed out that there is not an inherent inferiority in the Audiographic Tele-learning technology, rather the telephone lines linking some North Dakota schools were the source of the audio/data transmission problems.)

TABLE 72: STUDENT RESULTS ON SPANISH AND GERMAN NATIONAL ACHIEVEMENT TESTS BY SUBJECT AREA

	SPANISH		GERMAN	
	Adjusted Raw Scores**	# of Students	Adjusted Raw Scores**	# of Students
INTERACTIVE TV	**34**	(33)	**31**	(38)
DIGITAL	25*	(14)	--	--
ANALOG	42	(19)	31	(38)
INSTRUCTION BY SATELLITE	**39**	(2)***	**31**	(25)
OSU	--		31	(25)
TI-IN	39	(2)***	--	--
SERC	(No students)		(No students)	
AUDIOGRAPHIC TELE-LEARNING	**36**	(27)	--	--

* Students in these schools had only 1 semester of a 2 semester course.

** Raw scores have been adjusted for differential number of questions on Spanish and German tests. Adjusted scores have been rounded to the nearest whole number.

*** Numbers too small to represent a significant finding.

Summary of Measures of Student Success in DL Courses

If we look at a composite of the five measures of student success in DL courses available to us--instructor, coordinator, and student perception of amount learned; second semester course grades; percentage of students who would enroll in another DL courses; student perception of whether improvements are needed in the course; and standardized test scores in German and Spanish--we are able to see some very distinct patterns emerge, while not relying on any single measure of student success.

The composite ranking detailed in the table below shows TI-IN consistently ranking first among the success variables with the exception of Variable 3--a higher percentage of students said they would not enroll in another DL class, indicating some degree of frustration with the course.

Analog and Digital technologies ranked second and third respectively in the composite ranking, with little difference among them. Both I-TV technologies scored highest in terms of percentage of students indicating they would enroll in another DL course. It could be inferred that it caused less student anxiety or frustration because this technology most nearly approximated that of a traditional class, i.e., there was immediate audio-visual access to the instructor.

Audiographic Tele-learning ranked fourth with fairly uniform rankings across Variables 1, 2, 3, and 4. Its top ranking was on standardized test scores, indicating a high level of student knowledge gained in spite of technological problems involved in the course.

Ranking lowest of the technologies studied were SERC and OSU by Satellite, again with fairly uniform individual rankings on the student success variables. SERC by Satellite's chief attribute lay in the course grades achieved by students. With OSU by Satellite, rankings on both the standardized German test score and on student perception of whether course improvements are needed were somewhat higher than on other variables.

At the risk of repetitiveness, it must always be remembered that educational technology serves only as well as it is implemented. Clearly a major problem with OSU by Satellite was the extent to which it was only partially implemented in some schools, thus incurring greater student frustration, a lower perception of amount learned, and lower student grades.

TABLE 73: Summary of Student Success Measures in DL Courses

	Y1 Inst., Coord, & Student Perception of Amount Learned[1]	Y2 2nd Sem Course Grades[2]	Y3 Would students enroll in another DL course[3]	Y4 Student Perception of Whether DL Course Improvements are Needed[4]	Y5 Nat'l Test Scores--German and Spanish[5]	Composite Rank
	RANK					
INTERACTIVE TV						
DIGITAL	3	4	1	3	--*	(3) 2.75
ANALOG	2	2	2	2	3	(2) 2.20
INSTRUCTION BY SATELLITE						
OSU	6	6	6	4	4	(6) 5.20
TI-IN	1	1	3	1	1**	(1) 1.40
SERC	5	3	5	5	--***	(5) 4.50
AUDIOGRAPHIC TELE-LEARNING	4	5	4	6	2	(4) 4.20

1 based on % responding to "learned a great deal"
2 based on % receiving "A" grades
3 based on % responding "Yes"
4 based on % indicating improvements are needed in DL course
5 based on adjusted raw scores on "Combined DL Student Results on National Examinations in Spanish and German"

* score not comparably based on two semesters' coursework, therefore omitted
** based on only 8 students
*** courses not taken in Spanish or German

RESEARCH SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Twenty-seven public schools in North Dakota participated in this research study which attempted a cross-technology comparison of the three major types of distance learning--Instruction by Satellite, Audiographic Tele-learning, and Interactive Television. A total of 23 courses were offered enrolling 334 students during the second semester, 1989-90, through six distance learning technology sub-types: Analog and Digital I-TV, Audiographic Tele-learning, and Instruction by Satellite through TI-IN Network in Texas, Oklahoma State University's Arts and Sciences Teleconferencing Service (OSU-ASTS), and the Satellite Educational Resources Consortium (SERC) in North Carolina.

Each technology sub-type represented a different approach to the common goal of providing an alternative method of expanding the curriculum in schools who, restricted by size and small population density, are not able to offer a comprehensive curriculum.

Distance learning in its several different forms clearly was viewed by the adopting North Dakota schools as a necessary and valuable solution to the need for affordable curriculum expansion. In its neophyte stage, acceptance of DL was widespread, criticisms were selective, and the future was painted as uniformly positive. Students reiterated the tone of the school administrators, but left ample room for questionning the appropriateness of DL technology for all students. Learning style differentials, just as in a traditional classroom, may limit the uniform applicability of DL technologies, but the adopting schools hold no apparent aspirations, as critics and teacher organizations often charge, for broadening the application of DL to general or core curriculum classes. Distance learning in North Dakota is seen as the means to curriculum equalization, allowing small schools a similar opportunity for providing student access to advanced or special courses.

<u>DL Student Attitudes and Characteristics</u>

- 84% enrolled because they were interested in the subject
- 95% of the DL students had plans for attending college
- 70% of the schools placed no restrictions on who was allowed to enroll in the DL courses
- 61% of the students had GPA's of 3.00 or above (on a 4.00 scale)

- 58% found no differences between the amount of homework given between DL and traditional classes; 15% thought DL classes had more homework, while 60% reported spending between 1-2 hours per week on DL homework
- 56% thought DL classes were the same level of difficulty as traditional classes; 34% though DL classes were harder
- 86% of the DL students felt a willingnessness to take responsibility for their own learning was most helpful in a DL class
- 43% of the DL students reported little or no interaction with the remote DL instructor
- 79% said they would enroll in another DL course if given the opportunity

School/Community Attitudes Regarding Distance Learning

- All administrators favored or strongly favored their local DL programs as did 96% of the student bodies, 83% of the communities, and 61% of the faculties
- 96% of the administrators were satisfied or very satisfied with the quality of DL instruction; 64% were satisfied with the costs involved

The Future of Distance Learning

- All DL administrators indicated they would recommend their particular technology to other districts
- All administrators saw DL serving a long-term need for expanding the curricular offerings in small schools
- 91% of the administrators said the number of DL courses would be expanded in their schools within the next 1-5 years
- 83% of administrators said they planned to broaden the usage of the technology within the next year to include either teacher inservice, community/business use, administrative/interschool use, and/or student enrichment programming
- 78% said they would likely use multiple DL technologies within the next five years
- 94% believed the need for DL would continue in their school

Impediments to Expansion of Distance Learning

- 94% of administrators felt the limitations of the local school district budget was a major impediment to expansion; 88% cited the lack of outside funding
- 75% felt state level policies and regulations would impede expansion

Characteristics of Classroom Coordinators/Supervisors

- 57% were full-time employees of the school as teachers and/or administrators
- 22% indicated receiving extra compensation for their DL supervision duties
- 52% simultaneously performed other duties during the DL class
- 59% had had a moderate or greater amount of experience with computers
- 52% of DL coordinators reported having received some training regarding the DL program
- Notably lacking, however, was training in the role of classroom supervisor among 70% of the DL coordinators

DL Program Characteristics

- Nearly two-thirds of the schools (65%) have modified their school calendar and 61% have modified their class bell schedule to accomodate the DL classes
- Only 30% of the schools' class bell schedules, however, perfectly coincide with the DL class schedule. As an accomodation, some schools release students early from or are admitted late to other classes; others tape live broadcasts for delayed viewing.
- In 22% of the schools students miss up to 10 minutes of the DL class because of overlap with other classes
- 57% of the schools had students who dropped a DL course
- Primary reasons for dropping the course, as assessed by the coordinator, were the difficulty level of the course and the lack of student motivation to put forth the effort required of them

Attitudes and Characteristics of Distance Learning Instructors

- The majority of DL instructors were experienced teachers, having more than 11 years teaching experience
- 75% of the remote instructors were full-time teachers
- The instructors' technological knowledge or experience was not extensive; with the exception of VCR's, tape recorders, and computers, most had had minimal experience with technical equipment
- All DL instructors received some form of training in that role
- Half of the instructors felt that teaching is more exciting in a DL class

- Two-thirds felt that they could teach "better" utilizing the distance learning's educational technology
- 75% saw little difference in carrying out a DL vs. a traditional teaching role
- Two-thirds believed that there is less student-teacher interaction in a DL class and that it is more difficult to know if students understand what is being taught
- All instructors did *not* believe that discipline is more of a problem in DL classes (Remember that only I-TV and Audiographic Instructors were surveyed.)
- 75% use a written curriculum in both their traditional and DL classes
- All instructors believed that flexibility, organizational skills, and an outgoing personality are essential attributes of DL instructors
- 75% believed that they covered essentially the same material at the same pace in either traditional or DL classes
- Two-thirds of the instructors believed there were aspects of the course or technology which needed to be improved upon
- All felt that the widespread use of their particular technology would grow

Necessity for Complete Implementation of Course Components

Differences in technology require differences in implementation practices. The major problem with Instruction by Satellite in North Dakota is the failure of schools to implement all components of the program. The existence of a full-time classroom coordinator to insure all software and computer components are regularly used, to facilitate contact with the instructor, and to deal with equipment operation is essential to student success. A critical difference between Interactive Television and Instruction by Satellite is the extent of flexibility in how the course can possibly be implemented. Little leeway exists for schools in implementing Digital or Analog I-TV--it is virtually an "all or none" technology. With Instruction by Satellite, especially OSU's Instruction by Satellite program, however, there are multiple components and pieces of equipment which schools may implement to varying degrees. This incomplete implementation clearly was the major factor in student opinion--59% of Instruction by Satellite students felt there were aspects of the course which needed improvement. In addition Instruction by Satellite students found the problems to be much more severe than did students involved with the other two technologies.

Identification/Certification of Classroom Coordinators

No direct comparison of student achievement in classrooms with coordinators who were certified teachers (in some area) as compared to coordinators who were not certified teachers was possible in the scope of the study. However, it is very clear from the data that the existence of someone performing the duties of classroom coordinator is directly tied to student achievement. Average student socres on national standardized Spanish and German tests were from 11-38% higher for those students for whom coordinator duties were being carried out by someone. Duties commonly associated with a classroom coordinator were more often carried out by the DL instructor in I-TV classes, making the added role of classroom coordinator much less essential than in either Satellite or Audiographic technologies. The role of coordinator is seen as most essential in Instruction by Satellite classes where the lack of teacher-student interaction is most pronounced and where such a coordinator is needed to insure the implementation and usage of the various course components.

It is therefore concluded that the existence of a classroom coordinator who is available on a full-time basis to assist students and participate in all classes is far more important than part-time supervision by a certified teacher or administrator. In addition, rudimentary knowledge of the subject matter, e.g., someone who speaks German, appears to be a more important coordinator attribute than teacher certification in another area.

Need for State Education Agency Role As Technology Information and Technical Assistance Provider

Thirty percent (30%) of North Dakota administrators initiating a distance learning program explored no technology other than the one adopted. Virtually all districts (93%) depended on outside consulting services in implementing the DL technology chosen, either through the Department of Public Instruction, an equipment dealer or supplier, a local telephone company, a private consultant, or a regional University. Seventy percent (70%) of the administrators encountered technical problems with the DL equipment installed. These findings indicate a need for readily and widely available information on and technical assistance for the DL options. Costs of implementation were shown to vary dramaticly even within technology sub-types, indicating a further benefit to be achieved from an independent, non-commercial information source to which local schools might have ready access. (North Dakota has

added a technology resource person to their staff, a model which other states could certainly follow.)

The Role of the Classroom Coordinator

In comparing student and coordinator perceptions of who performs specific tasks in the DL classroom, several observations can be made:

(1) As would be expected, the percentage of coordinators who report that they themselves perform each task is slightly higher than the students' account of supervisor/coordinator performance of the same duties.

(2) Student and coordinator perceptions involving coordinator learning of the course material along with the students or coordinator participation in all classes are nearly idential.

(3) Coordinators tend to allocate more responsibility for carrying out tasks to the remote teachers. Students tend to believe that the remote teachers do less than coordinators indicate.

(4) A validity check of student vs. coordinator perceptions indicates nearly identical percentages on teacher performace of two obvious tasks--administering and grading of tests.

(5) A reasonable explanation for variances in student and coordinator perceptions lies in the liklihood that coordinators respond on the basis of having performed any single task for any student. Students, on the other hand, are more likely to respond based on their *own* individual experiences. It is therefore logical that a small discrepancy would occur between student and coordinator percentages on any task which would be performed for or with individual students. Indeed, when comparing percentages, we find that very little discrepancy occurs when looking at group-oriented tasks such as administering/grading tests, participating in/watching all classes, constructing quizzes, etc.

Remote teachers in I-TV classes significantly downplayed the role of the classroom coordinator as disciplinarian. Only 8% of the instructors indicated that discipline is carried out by the coordinator as compared to 34% in the coordinator's opinion and 41% in the students' opinion. I-TV instructors similarly downplayed the coordinator role in troubleshooting problems with equipment.

Even moreso than students, I-TV instructors severely critiqued the role of the coordinator with respect to identifying or solving individual

student problems and helping students find answers to problems. (Do keep in mind, however, that the role of the coordinator in the I-TV classroom is much different than that in the Satellite or Audiographic classroom.)

This further supports the finding that the role of classroom coordinator should be adapted to the specific DL technology implemented. Ready access to technology-specific coordinator training is highly desirable, with particular emphasis on the role of the coordinator in the classroom.

Student Characteristics Associated with Student Achievement

The probability of greater student achievement is enhanced by:

- a higher student class rank
- a student GPA above 2.00 (on a 4.00 scale)
- a high level of student motivation

DL Course Characteristics Associated with Student Achievement

The probability of greater student achievement is enhanced by:

- complete implementation and student utilization of all course components
- the performance of the following tasks by *someone*, e.g., the remote instructor, the classroom supervisor, or other students: (Tasks are listed in order of priority)
  - -- identifying and solving individual student problems in the course
  - -- maintaining discipline
  - -- answering simple questions or helping students
  - -- learning the course material along with the students
  - -- troubleshooting problems with equipment
  - -- constructing quizzes or worksheets to assist student learning
  - -- participating in or watching all classes along with students
  - -- motivating students to do well

Student Achievement in Distance Learning Classes

There is no evidence to suggest that the achievement of DL students is less than that of traditionally taught students. The interaction between specific student and individual course characteristics, the technology sub-type and method of implementation, however, prevents a clear prescription for one technology type over another when looking only at student achievement.

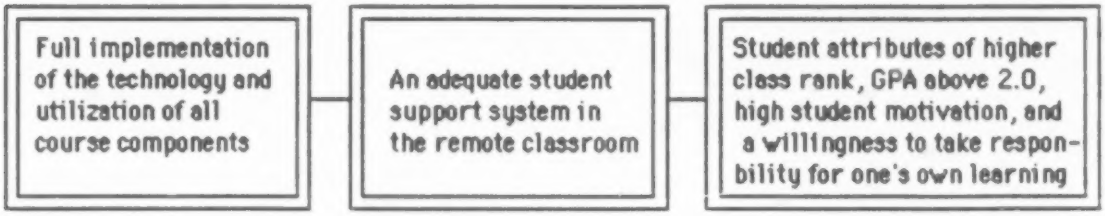
First of all, it is clear that all students do not succeed equally well given a DL instructional format, just as all students do not succeed equally well given limited instructional methods in a traditional classroom. It is apparent, although beyond the scope of current

investigation, that learning style has an effect on student success in DL courses.

Secondly, the degree to which the technology most closely mimics a traditional classroom--that is, it allows for immediate or nearly immediate student-teacher verbal and visual interaction--reduces the level of student frustration and increases the willingness of students to enroll in other DL courses. This statement must be qualified, however, by the fact that actual student achievement can be just as high or higher in non-interactive forms of DL, given high student motivation, a study/work ethic, or adequate student support through enhancement of the role of the classroom coordinator.

Certainly a major outcome of this study is the finding that, if fully implemented with an adequate student support network, instruction via distance learning is a workable, productive means of offering advanced or special classes to students. How well each individual student does in the DL class, however, is further dependent on the individual student's characteristics.

In order to insure maximum student success in DL courses, three elements must be in place:


Full implementation of the technology and utilization of all course components
An adequate student support system in the remote classroom
Student attributes of higher class rank, GPA above 2.0, high student motivation, and a willingness to take responbility for one's own learning

(1) There must be full implementation of the technology and all course components;
(2) There must be an adequate student support system in the remote classroom geared specificly to the technology sub-type utilized; and
(3) Students selected for DL course enrollment should have a high class rank, a GPA above 2.0, be highly motivated, and exhibit a willingness to take responsibility for their own learning.

This is not to say, however, that all three elements must be fully operative in order for students to learn or for a course to be successful. Some students will succeed regardless of whether any support network exists or whether the course is fully implemented or not. It is just as likely, however, that an unmotivated student with a GPA of 1.5 will not

succeed in a partially implemented class with no student support system available.

It is concluded, therefore, that as the existence of any one element decreases, greater attention to the other other two elements will yield improved chances for student success. For example, the chances for success of an average student with a mid-level class rank whose academic motivation leaves something to be desired can be enhanced by a supportive remote classroom coordinator who understands the need to participate in all classes, insure usage of all course components, and intervene as individual student problems or questions emerge.

An Assessment of Technology Sub-Types

With attention having been given to the intervening variables affecting student success, the composite ranking of the technology sub-types below yields a reliable assessment of the various distance learning technologies operative in North Dakota.

When combining the issues of cost, student achievement (test scores, grades, and perceived amount learned), coordinator and administrator satisfaction with the technology, frequency of student-teacher interaction, and existence of technical or other problems, Analog Interactive Television, TI-IN by Satellite, and Digital I-TV rank at the top. Audiographic Tele-learning ranks at the mid-level with OSU and SERC by Satellite ranking last.

A cursory look at cost effectiveness shows that the three most expensive technology sub-types--Analog I-TV, TI-IN by Satellite, and Digital I-TV--also rank highest on the composite assessment score. OSU by Satellite, while least expensive to implement and maintain, also ranked low on the composite score. Audiographic Tele-learning, with both relatively low initial and subsequent costs, ranked in the middle on the composite score. SERC by Satellite appears to be least cost effective in that its costs are high (given the state fee) and its composite ranking is lowest.

With the exception of cost, the technology sub-type ranks on individual assessment measures are strikingly similar, making such conclusions more reliable than if based on a single measure.

TABLE 74: COMPARISON RANKS OF DISTANCE LEARNING TECHNOLOGY SUB-TYPES--A COMPOSITE ASSESSMENT

	National Standardized Test Scores in German & Spanish	Student, Coordinator & Instructor Perception of Amt. Learned by Students	Willingness of Students to to Enroll in Another DL Course	Administrator Satisfaction with the DL Course[1]	Coordinator Impression of DL Course	Frequency of Student-Teacher Interaction	Student Perception of Whether Improvements are Needed in the Course	2nd Sem Grades	Initial Implementation Costs per School	Estimated Annual Cost per School[2]	Composite Rank
INTERACTIVE TV											
Digital	--*	3	1	3	2	2	3	4	4	5	3 (3.00)
Analog	3	2	2	2	1	3	2	2	6	3	1 (2.60)
INSTRUCTION BY SATELLITE											
TI-IN	1**	1	3	1	3	6	1	1	5	4	1 (2.60)
OSU	4	6	6	4	6	5	4	6	1	1	5 (4.30)
SERC	--***	5	5	6	5	4	5	3	3	6	6 (4.67)
AUDIO-GRAPHIC TELE-LEARNING	2	4	4	5	3	1	6	5	2	2	4 (3.40)

1 based on 15 items relating to course satisfaction

2 SERC costs include $35,000 state fee; fee scheduled to increase substantially

* scores not comparably based on two semesters' coursework, therefore omitted

** based on only 8 students

*** courses not taken in German or Spanish

Need for Continued Systematic Distance Learning Research

Little has been done in the way of evaluative distance learning research. Clearly, more is needed on a multi-state or national level in order to be able to statistically deal with some of the more refined questions raised by this study:

(1) What interaction exists among student characteristics, course components, and student support systems by technology sub-type? Is it indeed possible to compensate for minimal criteria in one area through special attention to criteria in other areas regardless of technology implemented? How is this interaction affected by differences in technology sub-type?

(2) What effect do student learning styles have on ability to succeed in distance learning formats?

(3) Does the performance of various "teacher tasks" by a classroom supervisor or other person yield *cumulative* improvement in student achievement, i.e., improve achievement additionally with each task performed?

(4) Does an investigation of distance learning student achievement in other than foreign language classes result in similar findings?

(5) How does full implementation and utilization of all course components affect the composite assessment of Instruction by Satellite vis-a-vis other forms of distance learning?

Recommendations to Previous or Potential Distance Learning Adopters

The primary purpose behind this study was to assist previous or potential adopters in initiating or improving the implementation of distance learning programs as well as to provide a research base to state education agencies and others formulating distance learning policy. The following recommendations are the result of these research findings:

(1) Local school access to non-commercial, reliable information concerning distance learning is imperative. Lacking a national or regional network to whom this responsibility might fall, state departments of education or public instruction must assume that responsibility.

(2) Administrators should base the decision to initiate a DL program on an identified need(s) in a specific curricular area(s), involving the faculty in the need identification process. Faculty response to distance learning will be facilitated through their early involvement in the decision-making process.

(3) The process of choosing a specific DL technology should be made at the level of the individual school rather than at the state level and should involve a conscious, locally-informed decision, based on a combination of factors, including:

- the courses to be offered
- the number and type of students to be served
- a full knowledge of the course components involved in the technology
- the ability to incorporate all course components into the local program
- the ability to incorporate an adequate student support network
- the financial resources available

(4) The assumption that all distance learning technologies are "plug-in" technologies must be avoided. Each technology varies with respect to its flexibility in implementation. While Interactive TV is largely an "all or none" technology, (i.e, it is either operative or it is not), Instruction by Satellite involves a much more multi-faceted implementation with varying degrees to which any component may be implemented. In order to gain maximum educational benefit from the technology chosen, it must be technically operative under local conditions and all intended components must be fully implemented and utilized.

(5) The clustering of several schools around a particular DL technology both facilitates the planned implementation of the program in the schools and serves as a support network during stages of problem resolution.

(6) The role of the classroom coordinator should be ascertained prior to course operation and should be delineated based on the technology chosen.

(7) It is highly recommended that state education agencies rethink traditional blanket requirements concerning teacher, grade-level, or subject-area certification of DL coordinators and concentrate more on educating district adopters regarding the differing coordinator roles required by different technologies. The existence of a classroom coordinator who is available on a full-time basis to assist students and participate in all classes appears to be of more benefit than the part-time supervision by a certified teacher or adminstrator. The educational value of a full-time classroom coordinator, however, varies by the technology implemented.

(8) Distance learning methodologies are not alike and therefore attempts to regulate their operation must take that diversity into account. To attempt to regulate distance learning along the lines of traditional accreditation and certification procedures may indeed short-circuit a valid school restructuring process.

(9) Training must be acquired or provided for every person acting as a classroom coordinator. A state-level training program for classroom coordinators (differentiated by technology sub-type) should delineate the specific duties to be performed by the coordinator in the classroom, cover the extent of supervision and involvement required in the class, and provide training on all technical equipment. The role of the state education agency in coordinating technical training with third-party providers should be encouraged.

(10) In lieu of a state education agency certification requirement for DL Coordinators, district compliance with respect to classroom supervision could be ascertained in the form of an annual "Distance Learning Supervision and Coordination Plan", thus focusing requirements away from paper certification and toward actual provision of student services.

(11) Training should be provided, as well, for local teachers serving as remote DL instructors. Beyond the obvious technical training needed, DL instructors should be provided with practice teaching opportunities utilizing the technology. In addition, exposure for a block of time with an experienced DL instructor could focus on

differences in instructional methods, attention to student on-task behavior, resolution of student problems, and relationship to the classroom coordinator. Continued access to an experienced DL instructor, either through periodic workshops or phone access, would be of great benefit. State education agencies could be of immeasurable assistance in helping to coordinate such training with regional colleges or universities with identified expertise.

(12) Ready access to technical support should be in place prior to the emergence of any problems. All participants in the program should know whom to contact at which location at what times in order to quickly resolve any problems which are surely to emerge at one time or another.

(13) Continued local monitoring of distance learning programs in terms of type of students enrolled, satisfaction with the program, measurement of student success criteria, and role of the classroom coordinator will insure continued program success while providing a sound information base from which program modifications can be made as necessary. Compilation of evaluative data within clusters of school adopters can yield further comparison data upon which program improvements can be made.

The future of Distance Learning in this country is tied directly to the ability of state education agencies and other educational policy-makers to facilitate the educational restructuring process. The ability of local teachers and administrators to adequately implement and operate DL programs is essential. Equally vital, however, is the need for state education agencies to provide informational and technical assistance to schools while selectively aiming their regulatory function toward encouraging educationally productive practices. Continued regulation of distance learning based on traditional criteria will serve neither to speed the larger school restructuring process nor insure improved educational benefits to students. One by one, experience by experience, educators are beginning to understand that distance learning is not a "threat" to the teaching profession; now they must also learn that with the freedom to teach in new and exciting ways comes the responsibility to wisely and judiciously utilize the technology for student benefit. Most appropriately said, in the words of a North Dakota Digital I-TV instructor, "distance learning is not for every student, nor is it for every teacher".